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MBC

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
2001 RECEIVING WATER MONITORING REPORT
RELIANT ENERGY ORMOND BEACH GENERATING STATION
VENTURA COUNTY, CALIFORNIA

2001 Survey

Prepared for:

Reliant Energy

Prepared by:

MBC *Applied Environmental Sciences*
3000 Redhill Avenue
Costa Mesa, California 92626

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March 2002

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TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

The 2001 National Pollutant Discharge Elimination System (NPDES) marine monitoring program for the Reliant Energy Ormond Beach generating station was conducted in accordance with specifications set forth by the California Regional Water Quality Control Board, Los Angeles Region (LARWQCB) in NPDES Permit No. CA0001198 dated 28 June 2001. The 2001 studies included physical monitoring of the receiving waters and underlying sediments and biological sampling of benthic infaunal assemblages and mussels. Fish and macroinvertebrate impingement studies were also conducted periodically throughout the year. Results of the 2001 surveys were compared among stations and with previous studies to determine if the beneficial uses of the receiving waters continue to be protected.

The Reliant Energy Ormond Beach generating station, formerly known as the Ormond Beach Generating Station, is owned and operated by Houston Industries.

WATER COLUMN MONITORING

Water quality parameters were measured in winter and summer 2001 during both ebb and flood tides at nine stations offshore the Ormond Beach generating station. In winter and summer, warm water lenses were noticeable at the surface at several stations in the vicinity of the discharge. However, temperatures at stations 1,000 ft upcoast and downcoast from the discharge were within 2°C of temperatures from the upcoast and downcoast control stations, complying with the Thermal Plan.

During both winter and summer, slightly higher surface temperatures occurred during afternoon sampling, the result of solar insolation. Slightly cooler bottom temperatures occurred during flood tide sampling in both winter and summer, reflecting the influx of cooler bottom waters on the incoming tide. In summer, higher dissolved oxygen and pH values recorded during the afternoon ebb tide were likely the result of increased photosynthesis throughout the day. Aside from increased surface water temperature in the vicinity of the discharge during winter and summer, and slight depressions in dissolved oxygen at the surface at these stations, there were no other detectable effects from the operation of the Ormond Beach generating station on the receiving waters.

SEDIMENT MONITORING

Sediment Grain Size

In 2001, sediments in the study area consisted primarily of fine sand, with lesser amounts of silt and clay. Sediments were finest at the discharge and coarsest 1,000 ft upcoast of the discharge. Average mean grain size in 2001 was near the long-term average for the study area. In many of the previous surveys in the study area, coarsest sediments were collected at the discharge; this was attributed to turbulence from the discharge, which can potentially prevent finer sediments from settling in the area. This year, however, finest sediments were collected at the discharge. Sediment composition and distribution in the study area appear to be primarily affected by natural causes. There were no spatial patterns apparent this year to suggest effects from the Ormond Beach generating station on sediment characteristics in the study area.

Sediment Chemistry

In 2001, sediment concentrations of all analyzed metals were lowest at the generating station discharge. Highest concentrations of chromium, copper, and zinc were recorded 3,000 ft downcoast of the discharge, and highest nickel concentration occurred 1,000 ft downcoast of the discharge. All metal levels in 2001 were well below levels determined to be potentially toxic to benthic organisms. Concentrations of all metals have been consistently low since 1993, with the exception of unusually high copper concentration at the discharge on 2000. Copper concentration at the discharge in 2001 was below the long-term average for the station. While higher metal concentrations are usually associated with finer sediments, higher metal levels offshore Ormond Beach have generally not been associated with finer sediments since 1998. Still, there was no spatial pattern apparent in 2001 to suggest the operation of the Ormond Beach generating station is influencing metal levels in the study area.

MUSSEL BIOACCUMULATION

Bay mussel tissue collected at the Ormond Beach generating station discharge in 2001 for bioaccumulation monitoring contained detectable concentrations of copper and zinc. Chromium and nickel were not detected in mussel tissues in 2001, and have not been detected in the area since 1991. Levels of both copper and zinc in mussels were within the range of values detected previously in mussel tissue from the area and from similar surveys in the Southern California Bight. It appears that the operation of the Ormond Beach generating station is not adversely affecting these metal levels in the study area.

BIOLOGICAL MONITORING

Infauna

The infauna community in the study area in 2001 was composed primarily of small annelids, Pacific sand dollars (*Dendraster excentricus*), arthropods, clams, and nemertean worms. Abundance, species richness, diversity, and composition of the community were similar among the five stations along the discharge isobath, with highest species richness at the discharge station, probably because of the additional habitat provided by shell fragments present in the sediment. Species richness and diversity were lower and community composition was somewhat different inshore of the discharge where the highest abundance was found. Parameters appeared to be only somewhat related to sediment characteristics, with fewer species but more individuals occurring where sediments were best sorted. Average density of organisms was 13,800 individuals/m^2, with a maximum density of 30,580 individuals/m^2 inshore of the discharge. The annelid *Apoprionospio pygmaea* was the most abundant species, comprising almost 29% of all the organisms collected. The next most abundant species, Pacific sand dollar, the annelids *Armandia brevis* and *Owenia collaris*, the cumacean *Diastylopsis tenuis*, and the clam plain tellin (*Tellina modesta*) were each a third or less abundant than *A. pygmaea*.

Infauna abundance, species richness, and diversity values were greater than the long-term averages for surveys conducted in the study area since 1978. The number of species collected in 2001 was greater than in all previous surveys except in 2000. Several species, including the community dominant, *A. pygmaea*, were more abundant than in previous surveys. The abundant clam *Mactromeris catilliformis* was taken for the first time in 2001. Overall, however, the community was similar to those in past surveys. A trend of increasing abundance and species richness since 1998 was apparent, but is probably part of the natural variability found in the nearshore habitat. Average long-term abundance has been greatest at the discharge and lowest inshore of the discharge, while average species richness has been greatest just downcoast of the discharge and lowest inshore. The only pattern relating to the discharge appears to be a slight decline in average abundance with distance from the discharge along the discharge isobath; average species richness was similar among stations along the discharge isobath.

Fish Impingement

Heat treatment and normal operations in 2001resulted in the entrainment and impingement of at least 47 species of fish and an estimated 15,583 individuals weighing over 2,687 kg. In addition, at least 19 species of macroinvertebrates, representing an estimated 11,225 individuals and weighing over 261 kg, were taken. Normal operations yielded 78.3% of the fish impinged, whereas 21.7% were taken during heat treatments. Species composition and abundance were similar to that noted in the previous ten years, but much greater than that seen in the unusually low years of 1999-2000. The changes seen are likely due to the absence of the recently departed La Niña, a cooler-than-normal oceanographic perturbation that is known to shift population centers. Especially significant is that this phenomena followed a two-year long El Niño that brought warmer-than-normal waters to southern California. The core species in the long-term record persist in 2001 and all indications are that the populations offshore remain diverse and healthy. The macroinvertebrate population was also diverse and healthy. There is no indication that the operation of the power plant had an appreciable adverse affect on the abundance or distribution of any species offshore of the Ormond Beach generating station.

CONCLUSIONS

The overall results of the 2001 NPDES monitoring program indicated that operation of the Reliant Energy Ormond Beach generating station had no detectable adverse effects on the beneficial uses of the receiving waters.

INTRODUCTION

This report presents and discusses the results of the 2001 receiving water monitoring studies conducted for the Reliant Energy Ormond Beach generating station, which is owned and operated by Houston Industries. The 2001 monitoring program was conducted in accordance with specifications set forth in National Pollutant Discharge Elimination System (NPDES) Monitoring and Reporting Program No. 5619 (Permit No. CA0001198) issued by the California Regional Water Quality Control Board, Los Angeles Region (LARWQCB) on 28 June 2001 (Appendix A). Results of the 2001 surveys were compared among stations and with past physical oceanographic and biological studies to determine what effects, if any, the generating station discharge is having on the marine environment, and if the beneficial uses of the receiving waters are being protected. Sampling included physical and chemical monitoring of the receiving waters and sediments, mussel bioaccumulation, and biological monitoring of infaunal assemblages. Fish and macroinvertebrate impingement studies were also conducted periodically throughout the year.

DESCRIPTION OF THE GENERATING STATION

The Reliant Energy Ormond Beach generating station is located on the coast of California, approximately 3.7 kilometers (km) southeast of the entrance to Port Hueneme in Ventura County (Figure 1). The station consists of two steam-electric, gas-fueled generating units, rated at 750 megawatts (Mw) each. At full load, the boiler of each unit produces 2.6 million kilograms (kg) of steam per hour which is supplied to tandem compound turbines at a temperature of 555.6°C.

Cooling water is supplied to the station through a 4.0-meter (m) inside diameter (ID) concrete conduit at a flow rate of about 475,000 gallons per minute (gpm). The intake structure is located 640 m offshore at a water depth of about 10 m Mean Low Lower Water (MLLW); the port is 2 m above the bottom and is covered with a velocity cap. Seawater enters the conduit at a velocity of about 82 centimeters per second (cm/s) and passes through a screening facility to remove marine life, trash, and other debris.

After passing through the screenwell, cooling water is pumped to two condensers (one per unit), where its temperature is elevated approximately 16.7°C when the plant is operating at full capacity. The heated effluent is returned to the ocean through a 4.3-m-ID conduit which terminates 457 m offshore, where the bottom depth is 9 m (MLLW). The discharge water is directed vertically upward at a depth of 6 m (MLLW) and exits at a speed of about 87 cm/s.

Approximately 20,000 gpm of the main flow are diverted to two auxiliary heat exchangers which are used to cool treated distilled water for other plant equipment. The temperature of this water is elevated approximately 5.6°C before it is returned to join the main stream in the discharge conduit.

During the 2 April 2001 winter survey, the Ormond Beach generating station operated 2 of 4 circulator pumps discharging 518.9 million gallons per day (mgd). Intake and discharge temperatures were 11.7 and 27.8°C, respectively, with a delta T of 16.1°C. During the 24 July 2001 summer survey, the generating station operated 2 of 4 circulator pumps discharging at the rate of 343 mgd. Intake temperature was 15.0°C, with an increase in water temperature across the condensers of 14.4°C resulting in a discharge temperature of 29.4°C. During 2001, the Ormond Beach generating station operated at 40% of its total operating capacity (Melchor and Schneider 2002, pers. comm.).

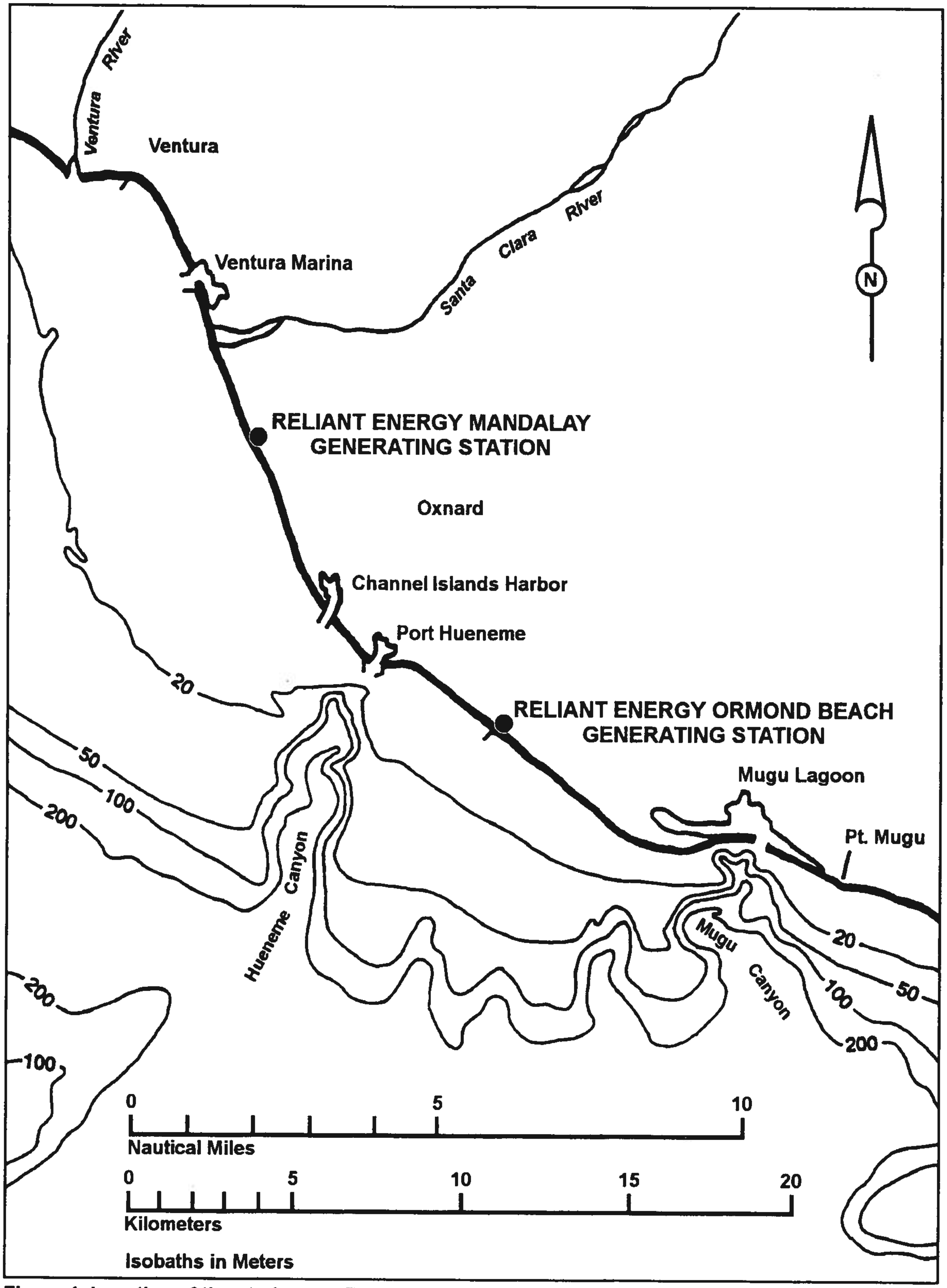


Figure 1. Location of the study area. Reliant Energy Ormond Beach generating station NPDES, 2001.

DESCRIPTION OF THE STUDY AREA

The Ormond Beach generating station is located on the coastal plain of the Ventura Basin which is defined by two coastal features: the barrier beaches at Point Mugu (11.3 km to the south) and the delta of the Ventura River (20.9 km to the north) (Figure 1). Prominent natural features of this portion of the Southern California Bight include the dunes along Mandalay Beach, the marshes and lagoon on the naval reservation near Point Mugu, and the straight, sandy beaches interrupted by the Ventura Marina, Channel Islands Harbor, and the harbor at Port Hueneme.

The physiography, climate, and general oceanography of the southern California coastal region all contribute to the general character of the study area. The fate of any thermal discharges into coastal waters is influenced by the complex interactions of the above factors. The plume in turn may alter the nature of the biota present in the area. All of these factors have long- and short-term cycles as well as non-periodic components. Winds, tides, and currents are particularly important since they determine to the greatest extent the actual fate of the thermal effluent.

Physiography

The general orientation of the coast from Point Conception to the Mexican border is northwest to southeast. The continental margin has been slowly emerging over geological time, resulting in a predominantly cliffed coastline, although it is broken by coastal plains in the vicinity of Oxnard-Ventura, Los Angeles, and San Diego.

The eight islands offshore from the southern California mainland strongly influence water circulation and oceanographic conditions throughout the Bight. The mainland shelf along the coast is narrow, ranging from less than two to almost 20 km in width, but averaging about 7 km. Seaward of the shelf is an irregular and geologically complex region known as the continental borderland. The bottom here comprises a series of basins and ridges which extend in depth from near-surface to depths in excess of 2,400 m.

Climate

Southern California is a climatic regime defined broadly as Mediterranean, which is characterized by short, mild winters and warm, dry summers. Monthly mean air temperatures along the coast range from 8°C in winter to 21°C in summer, with daily minima dropping slightly below freezing and maxima reaching above 37°C.

Annual precipitation near the coast averages about 46 cm, 90% of which occurs between November and April. Drainage of the coastal region is largely by way of many short streams which normally flow only during rainstorms. Only a small part of the storm runoff actually reaches the ocean, most being impounded by dams and used for other purposes.

Sea breezes, which develop from differences in heating between land and sea, combine with prevailing coastal winds (which blow out of the northwest in summer) to produce strong onshore winds. In summer the sea breezes usually begin at mid-day and may continue through the late afternoon, with speeds reaching 37 km/hour. In late fall and winter, reverse pressure systems frequently develop. Coastal winds tend to be from the southeast from November through February and typically blow from early afternoon to 2000 hours (hr).

Currents

Water in the northern Pacific Ocean is driven eastward by prevailing winds until it impinges on the western coast of North America where it divides and flows both north and south. The southern component is the California Current, a diffuse and meandering water mass which generally flows to the southeast. There is no fixed western boundary to this current, but more than 90% of its transport is within 725 km of the California coast.

South of Point Conception the California Current diverges. One branch turns northward and flows inshore of the Channel Islands, forming the Southern California Countercurrent. Surface speed in the countercurrent ranges between 5 and 10 cm/s. The general flow pattern is complicated by eddies in the Channel Islands region and it fluctuates seasonally; is more strongly developed in summer and autumn, and weak or occasionally absent in winter and spring. Generalized surface water circulation off southern California is shown in Figure 2.

Nearshore, coastal currents are strongly influenced by a combination of wind, tides, and local topography. When wind-driven currents are superimposed on tidal motions, a strong diurnal pattern is usually apparent. Therefore, short-term observations of currents near the coast often vary in both direction and speed.

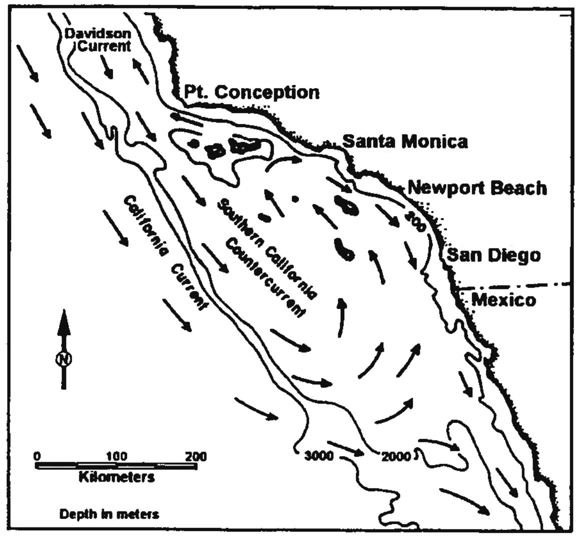


Figure 2. Surface circulation in the Southern California Bight (from Jones 1971). Reliant Energy Ormond Beach generating station NPDES, 2001.

Tides

Tides along the California coast are mixed, with two unequal highs and two unequal lows during each 25 hr period. The tide is a long-period wave that is a combination of semidiurnal components (each having nearly 12 hr periods) and diurnal components with nearly 25 hr periods. In the eastern North Pacific Ocean, the tide wave rotates in a counterclockwise direction so that tidal extremes occur progressively later in the day northwards along the coast. As a result, flood tide currents flow upcoast and ebb tide currents flow downcoast.

Upwelling

The predominant northwesterly winds are responsible for large scale upwelling along the California coast. From about February to October, these winds induce offshore movement of surface water which is replaced by the upwelling of deeper ocean waters. The upwelled water is colder, more saline, lower in oxygen, and higher in nutrient concentrations than surface waters. Thus, upwelling not only alters the physical properties of the surface waters but also affects biological productivity.

RECEIVING WATER CHARACTERISTICS

The capacity of the marine environment to assimilate waste heat depends on its ability to dilute and disperse it. The assimilation capacity depends on the ambient water temperature as well as the amount and temperature of the thermal discharge. Dispersion is largely determined by local wind, wave, tide, and current patterns. The following summary concerns general patterns of natural ocean temperatures off southern California as well as other physical characteristics of the nearshore water mass.

Temperature

Natural seawater temperature fluctuates throughout the year as a result of seasonal and diurnal variations in meteorological conditions such as wind, air temperature, insolation, cloud cover, and relative humidity as well as oceanographic conditions such as currents, tides, turbulence, and vertical mixing. The LARWQCB defines natural temperature as "the temperature of the receiving water at locations, depths, and times which represent conditions unaffected by any elevated temperature waste discharge."

Previous studies have shown that natural surface temperatures may vary several degrees in a single day, depending upon time of day, time of year, and prevailing oceanographic and meteorological conditions. Temperatures offshore Ormond Beach range from monthly means of 13.3°C in February and March to 16.7°C in August. Mean maximum natural surface temperatures are 14.4°C during the winter and 22.2°C in the summer (MBC 1975).

When there are large differences between surface and bottom temperatures, a thermocline may develop (a thermocline is an area of rapid temperature change between two layers of water). Natural thermoclines are formed when absorption of solar radiation at the surface produces a heated surface layer which is not mixed vertically. Artificial thermoclines may result from the discharge of warm water above cooler waters and the lack of vertical mixing. Off southern California, a reasonably sharp thermocline usually develops in summer at depths up to 30 m. Only very weak thermoclines appear in winter.

Salinity

Salinity is a measure of the concentration of total dissolved salts in the water, and although relatively constant in the open ocean, it varies in the nearshore as a result of freshwater runoff and evaporation. Mean surface salinities at the Ventura Marina between 1965 and 1971 ranged from 24.1 milligrams per liter (mg/l) during a period of high storm runoff to a high of 33.9 mg/l (IRC 1973). Yearly averages were about 33.5 mg/l.

Dissolved Oxygen

Dissolved oxygen (DO) is used by plants and animals in normal respiration and metabolic processes. It is replenished in seawater by gaseous exchange with the atmosphere and through photosynthesis by plants. Concentrations in surface waters off Ormond Beach between July 1970 and January 1973 ranged from 7.3 to 11.0 mg/l (IRC 1973). The high values were probably a result of active photosynthetic processes and the low values a result of mixing with oxygen-depleted subsurface water.

Hydrogen Ion Concentration

The hydrogen ion concentration (pH) in southern California surface waters varies narrowly around a mean of approximately 8.0 and decreases slightly as the water becomes more acidic with depth. Maximum pH values recorded during four quarterly surveys offshore Ormond Beach between December 1973 and September 1974 were 8.0 to 8.6 (EQA/MBC 1975).

Hydrography

The ocean floor of the Ventura Basin is characterized by three distinct areas: a broad and gently sloping area directly in front of the Ormond Beach generating station, and two submarine canyons (Hueneme and Mugu) at either edge (Figure 1 and IRC 1973). At Ormond Beach, the 20 fathom contour is within 7 km of shore, while to the north at Mandalay it is no closer than 13 km.

General nearshore circulation in the area is affected by the two canyons, Port Hueneme, Channel Islands Harbor, the Ventura Marina, and the Santa Clara River. However, there is little evidence that these features significantly affect circulation in the immediate study area.

Littoral Drift

In response to longshore currents, sand typically moves parallel to shore, then into the heads of submarine canyons. In the Hueneme area, the net littoral sediment transport is downcoast in the range of 600,000 to 900,000 m^3 per year. The construction of the harbor entrance effectively trapped much of the normal supply to Ormond Beach; that which was not trapped was diverted into the head of Hueneme Canyon. Erosion downstream of the harbor-entrance jetties is about 900,000 m^3. To offset these losses, slightly more than 1,500,000 m^3 are dredged biannually and deposited to intertidal and subtidal habitats at Ormond Beach. This deposition has a detrimental impact on the nearshore biota. Erosion southeast of the jetties continues at the rate of 1,500,000 m^3 per year.

BENEFICIAL USES OF RECEIVING WATERS

The Water Quality Control Plan for the Santa Clara River Basin adopted by the California Regional Water Quality Control Board (1994) lists seven beneficial uses of waters in the nearshore zone of the Santa Clara-Calleguas Hydrographic Unit, which includes Ormond Beach and the study area. These uses are:

Water Contact Recreation (REC-1)

As defined by the State Board, this use involves actual body contact with the water and includes swimming, wading, waterskiing, skin diving, SCUBA diving, surfing, sport fishing, and any use where ingestion of water is possible.

Non-contact Water Recreation (REC-2)

This use involves the presence of water but no contact with it. Examples include picnicking, sunbathing, hiking, beachcombing, camping, and pleasure boating.

Navigation (NAV)

This consists of the commercial, military, and recreational use of the water for transportation.

Marine Habitat (MAR)

This use provides for the preservation of the marine ecosystem and includes the propagation and maintenance of fish, shellfish, marine mammals, waterfowl, and vegetation such as kelp.

Ocean Commercial and Sportfishing (COMM)

This use includes the commercial collection of various fish and shellfish (including those taken for bait purposes) and sport fishing in the ocean, bays, estuaries, and similar non-freshwater areas.

Shellfish Harvesting (SHELL)

This use includes the collection of such species as clams, oysters, abalone, shrimp, crab, and lobster for both commercial and sport purposes.

Preservation of Rare and Endangered Species (RARE)

This beneficial use includes the provision of an aquatic habitat, at least in part, for the survival of certain species that have been established as being rare or endangered.

Although all of the above are not directly associated with the receiving waters of the Ormond Beach generating station at all times, they may be reasonably assumed to constitute occasional beneficial uses of the nearshore waters in the study area.

MATERIALS AND METHODS

SCOPE OF THE MONITORING PROGRAM

The 2001 monitoring program for the Reliant Energy Ormond Beach generating station was conducted by MBC Applied Environmental Sciences (MBC) in accordance with specifications set forth in the NPDES Monitoring and Reporting Program (Appendix A). The monitoring program included winter and summer water column profiling, summer sediment sampling for grain size and chemistry, mussel sampling for bioaccumulation, summer biological sampling for benthic infauna, and periodic impingement sampling of fish and macroinvertebrates

STATION LOCATIONS

The locations of the monitoring stations are described in Appendix A and shown on Figure 3. The 2001 monitoring program included nine water quality (RW) stations, and six sediment and benthic infauna (B) stations.

WATER COLUMN MONITORING

Temperature (°C), dissolved oxygen (DO), hydrogen ion concentration (pH), and salinity were continuously measured throughout the water column during the winter and summer surveys. Sampling was conducted on both flood and ebb tides at each of the nine receiving water monitoring stations (Figure 3). Data were obtained *in situ* using an SBE 9/17 CTD water quality profiling system (Sea-Bird), and averaged at 1.0 m intervals. In the field, the data were transferred from the Sea-Bird to floppy disk for storage. In the laboratory, data were processed using Sea-Bird proprietary software (SeaSoft ver. 4.21). The resulting information was imported into Microsoft Excel spreadsheets for further reduction and analysis.

SEDIMENT MONITORING

Sediment samples were collected during the summer survey at six stations (Stations B1-B6) by biologist-divers. Samples for grain size analysis were collected using a 3.5-cm-diameter, 15-cm-long plastic core tube. Three replicate samples for metals analysis were collected in precleaned glass jars.

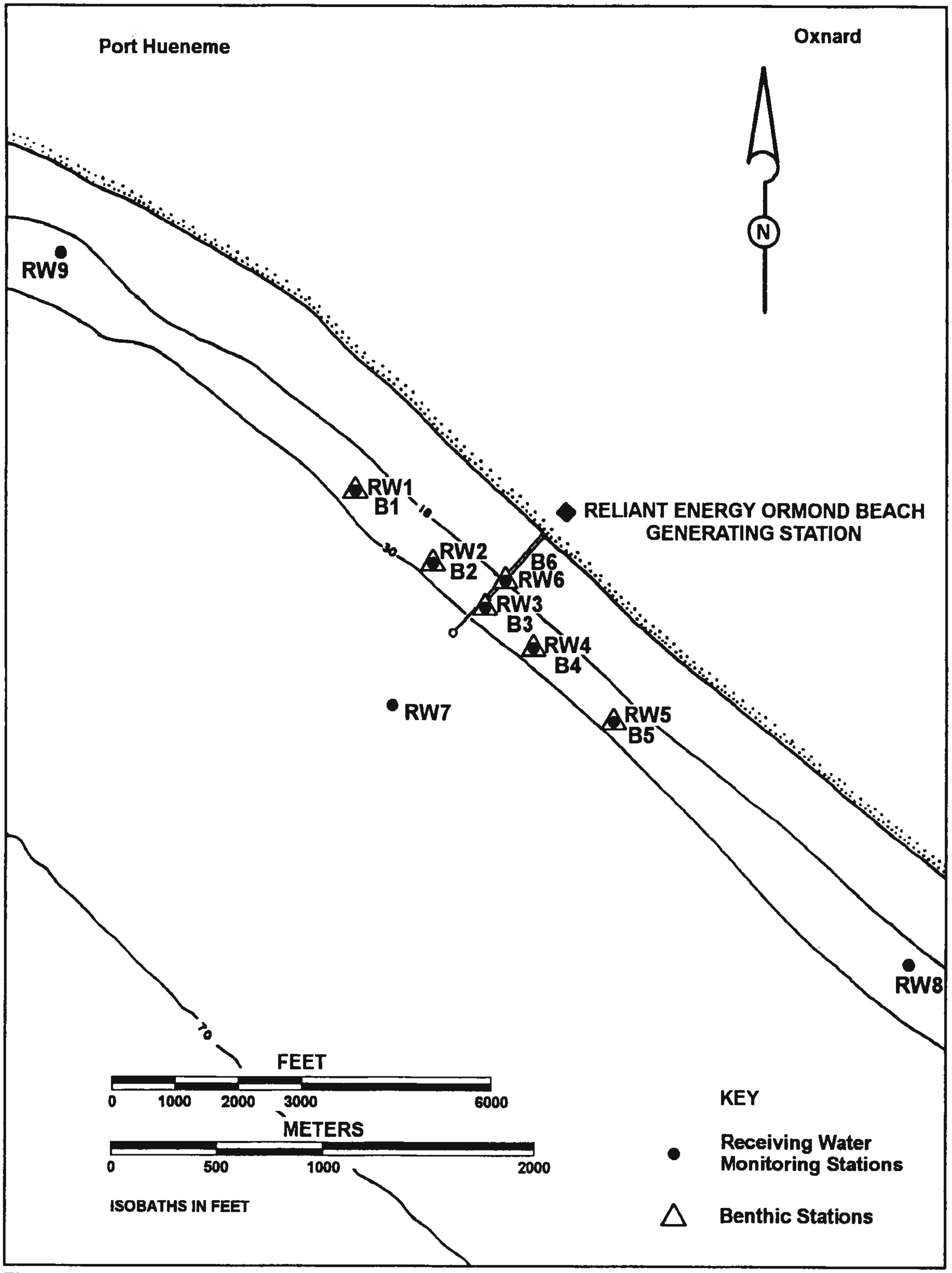


Figure 3. Location of the monitoring stations. Reliant Energy Ormond Beach generating station NPDES, 2001.

Sediment Grain Size

The size distributions of sediment particles were determined using two techniques: laser light diffraction to measure the amount and patterns of light scattered by a particle's surface for the sand/silt/clay fraction, and standard sieving for the gravel fraction. Laboratory data from the two methods were combined and presented in tabular format. Resulting analyses include mean and median grain size, standard deviation of the grain size, sorting, skewness, and kurtosis. Data were plotted as size-distribution curves. Additional details are provided in Appendix B.

Sediment Chemistry

Sediment chemistry samples were placed on ice in the field and returned to the laboratory. Samples for metal analysis were maintained at approximately 4°C until laboratory procedures began. Sediments were analyzed for total percent solids and the following metals: chromium, copper, nickel, and zinc. Environmental Protection Agency (EPA) method 160.3 was used for determining percent solids while EPA method 6010 was used for metal analysis. Data were converted to dry weight values.

MUSSEL BIOACCUMULATION

Bay mussels (*Mylitus edulis*) were collected as close to the discharge as possible by biologists during the summer survey for bioaccumulation monitoring. Forty-five (45) mussels with shell lengths ranging from 52 to 73 millimeters (mm) and averaging 59.8 mm were processed according to methods used in the California Mussel Watch (Appendix A and SWRCB 1986). Soft tissue from the mussels was analyzed for copper, chromium, nickel, and zinc. Results were compared to levels found in other mussel watch programs, that were collected and analyzed concurrently for another NPDES monitoring program.

BIOLOGICAL MONITORING

The biological monitoring program consisted of benthic infaunal sampling using diver-operated box corers, and fish impingement sampling of fish and macroinvertebrate populations taken during heat treatment and normal operation.

Benthic Infauna

Benthic infauna sampling was conducted at six stations (Stations B1 - B6) at the same time as sediment sampling, using a hand-held, diver-operated box corer (Figure 4). The box corer collects a uniform sample of 100.0 cm^2 surface area to a depth of 10.0 cm for a total sample volume of 1.0 liter. The box corer is pushed into the sediments by a diver and a closing blade is swung across the mouth of the box. Upon withdrawal from the sediments, the sample is sealed in the box by a neoprene lid for transport to the surface.

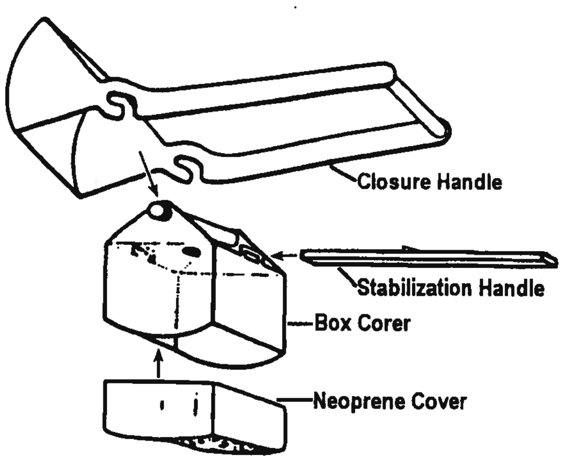


Figure 4. Diver-operated box corer used to collect infaunal samples. Reliant Energy Ormond Beach generating station NPDES, 2001.

Four replicate 1.0 liter sediment samples were collected at each of the three stations. Samples were screened in the field using a 0.5 mm U.S. Standard Sieve, labeled, and fixed in buffered 10% formalin-seawater. In the laboratory, samples were transferred to 70% isopropyl alcohol, sorted to major taxonomic groups, identified to the lowest practical taxonomic level, and counted. Representative specimens were added to MBC's reference collection.

Following identification, the weight of organisms for each major taxonomic group in each replicate was obtained. Specimens were placed on small, pre-weighed mesh screens which had been submersed in 70% isopropyl alcohol, blotted on a paper towel, and air-dried for five minutes. Large organisms were weighed separately.

Fish Impingement

Fish impingement sampling is conducted during representative periods of normal operation and during all heat treatment procedures to obtain an estimate of total impingement for the year. A normal operation survey is defined as a sample of all fish and macroinvertebrates entrained by water flow into the generating station intake and subsequently impinged onto traveling screens during a 24-hr period with all circulating pumps operating, if possible. The number of operational days is usually less than 365 because of plant maintenance downtime and seasonal fluctuations in the demand for electricity, which may result in decreased water flow into the power plant. Normal operation abundance and biomass for the year are estimated by extrapolating the monitored abundance and biomass based on the percentage of the annual flow into the plant on the days sampled. Exceptions to this method are made where such extrapolations would result in exaggerated counts for species that typically occur in low abundance.

A heat treatment is an operational procedure designed to eliminate mussels, barnacles, and other fouling organisms, which grow in and occlude the generating station conduits. During a heat treatment, heated effluent water from the discharge conduit is re-entrained via cross-connecting tunnels to the intake conduit until the water temperature rises to approximately 40.5°C in the screenwell. This temperature is maintained for a period of at least one hour during which time all mussels, barnacles, and incidental fish and invertebrates living within the intake conduit and forebay succumb to the heated water. All material is subsequently impinged onto the traveling screens and removed from the forebay. The fish and macroinvertebrates are then separated from incidental debris, sorted by species, identified, and counted. Fish are measured in millimeters (mm) to either standard length (SL), total length (TL), or disc width (DW), as appropriate, and examined for external parasites, anatomical anomalies, and other abnormalities. Aggregate weights are taken by species for both fish and macroinvertebrates. Unusual specimens and those of uncertain identity are preserved in 10% formalin-seawater and returned to the laboratory for positive species determination and, if warranted, retention in the MBC collection of voucher species. Data are collected for each heat treatment survey and combined with the estimated normal operation data to determine the total impingement loss for the year.

STATISTICAL ANALYSES

Summary statistics developed from the biological data included the number of individuals (expressed as both number per grab and density), number of species and Shannon-Wiener (Shannon and Weaver 1962) species diversity (H') index. The diversity equation is as follows:

Shannon-Wiener

$$H' = -\sum_{j=1}^{S} \frac{n_j}{N} \ln \frac{n_j}{N}$$

where:

H' = species diversity
n_j = number of individuals in the j^{th} species
S = total number of species
N = number of individuals

Data from infaunal coring collections were subjected to log transformations (when necessary) and classified (clustered) using the SYSTAT (SYSTAT ver. 5.0, Systat, Inc., Evanston, IL) clustering module (Wilkinson 1986). Cluster analysis provides a graphic representation of the relationship between species, their individual abundance, and spatial occurrence among the stations sampled. In theory, if physical conditions were identical at all stations, the biological community would be expected to be identical as well. In practice this is never the case, but it is expected that the characteristics of adjacent stations would be more similar than those distant from one another. The dendrogram shows graphically the degree of similarity (and dissimilarity) between observed characteristics and the expected average. The two-way analysis utilized in this study illustrates groupings of species and stations, as well as their relative abundance, expressed as a percent of the overall mean. Two classification analyses are performed on each set; in one (normal analysis) the sites are grouped on the basis of the species which occurred in each, and in the other (inverse analysis) the species are grouped according to their distribution among the sites. Each analysis involves three steps. The first is the calculation of an inter-entity distance (dissimilarity) matrix using Euclidean distance (Clifford and Stephenson 1975) as the measure of dissimilarity, where:

Clifford and Stephenson

$$D = \left[\sum_{1}^{n} (x_1 - x_2) \right]^{1/2}$$

D = Euclidean distance between two entities
x_1 = score for one entity
x_2 = score for other entity
n = number of attributes

The second procedure, referred to as sorting, clusters the entities into a dendrogram based on their dissimilarity. The group average sorting strategy is used in construction of the dendrogram (Boesch 1977). In step three, the dendrograms from both the site and species classifications are combined into a two-way coincidence table. The relative abundance values of each species are replaced by symbols (Smith 1976) and entered into the table. In the event of extreme high abundance of a single species, abundance data are transformed using a natural log transformation [ln(x)].

DETECTION LIMITS

Detection limits (DL) used in reporting chemistry results are interpreted as the smallest amount of a given analyte that can be measured above the random noise inherent in any analytical tool. Thus, any value below the DL cannot be considered a reliable estimate of analyte concentration. Therefore, where a test for a given analyte results in a level below the DL, a "none detected" (ND) value has been assigned. The complication of what numerical value to substitute for ND in statistical calculations is addressed by EPA (1989, Section 5.3.3). When values for a given analyte are ND for all stations, then means and standard deviations will also be considered ND. However, when an analyte is detected at some stations and not at others, statistical calculations can be made by substituting ND values with either (a) zero, (b) one-half the average detection limit, or (c) the average detection limit (EPA 1989). Determining which substitution to use is based on whether or not substantial information exists to support the historical presence or absence of a given analyte at the station location. Since chemistry analyses have repeatedly resulted in ND values at the same stations through past surveys, ND values have been replaced with zeros in performing statistical calculations. This decision is also based on the fact that detection limits differ in virtually all past surveys, which would confound any yearly comparison if options (b) or (c), from above, are used. Historical raw data are presented in the appendices for possible supplementary study.

RESULTS

FIELD OPERATIONS

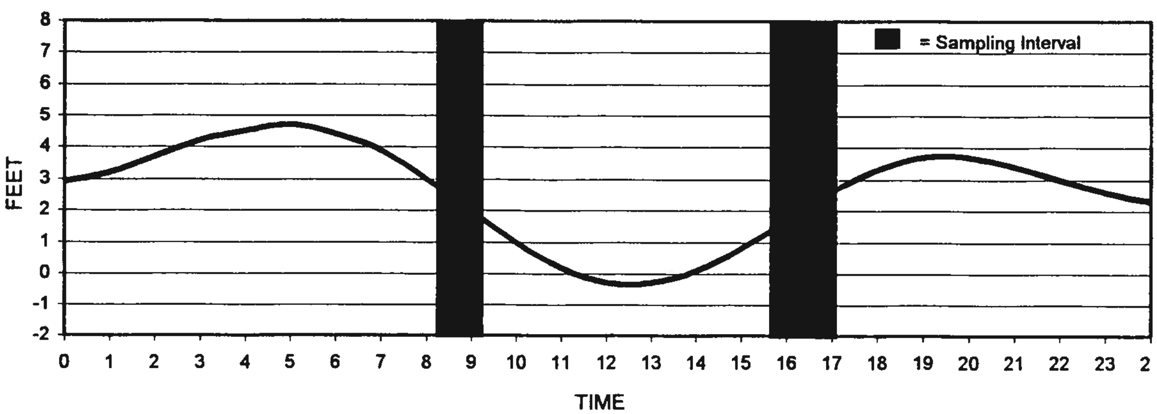
The NPDES surveys at Reliant Energy Ormond Beach generating station were conducted on 2 April, 24 and 25 July, and 19 October 2001. Latitude/longitude coordinates for all receiving water (RW) and benthic (B) stations are listed in Table 1.

Water quality data were collected in winter at Stations RW1 through RW9 on 2 April during two tidal periods. Ebb tide was sampled between 0805 and 0915 hours (hr) and flood tide was sampled between 1535 and 1710 hr (Figure 5). On the day of sampling, the tide fell from a high of +4.7 ft MLLW (Mean Lower Low Water) at 0451 hr to a low of -0.3 ft MLLW at 1236 hr, then rose to a high of +3.7 ft MLLW at 1928 hr. Skies changed from partly cloudy to clear during the day. Winds increased from west 5 to 15 kn, with a south-southwest 2 to 4 ft swell. During sampling the plant was in reverse flow configuration for intake structure maintenance, which took place over a three month period.

Table 1. Latitude/longitude coordinates of sampling stations. Reliant Energy Ormond Beach generating station NPDES, 2001.

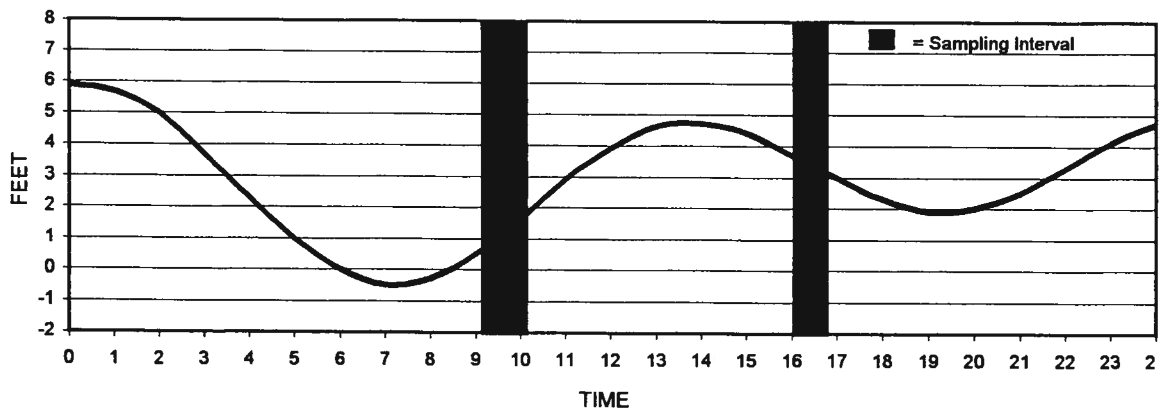
Stations			
Water Quality	Benthic	Latitude	Longitude
RW1	B1	34°07.65'	119°10.96'
RW2	B2	34°07.45'	119°11.69'
RW3	B3	34°07.41'	119°10.44'
RW4	B4	34°07.33'	119°10.32'
RW5	B5	34°07.09'	119°10.08'
RW6	B6	34°07.51'	119°10.38'
RW7	-	34°07.12'	119°10.72'
RW8	-	34°06.53'	119°09.32'
RW9	-	34°08.15'	119°11.75'

Water quality data were collected in summer at Stations RW1 through RW9 on 24 July during two tidal periods. Flood tide was sampled between 0900 and 1010 hr and ebb tide was sampled between 1600 and 1655 hr (Figure 6). On the day of sampling, the tide rose from a low of -0.5 ft MLLW at 0714 hr to a high of +4.7 ft MLLW at 1344 hr, then fell to a low of +1.9 ft MLLW at 1923 hr. Skies changed from overcast to clear during sampling. The wind increased from west 2 to 12 kn and seas were 1 to 4 ft from the west.



Pacific Daylight Time		Monday				April 2, 2001	
Time	Height	Time	Height	Time	Height	Time	Height
0451	4.7'	1236	-0.3'	1928	3.7'		

Figure 5. Tidal rhythms during water quality sampling, winter survey. Reliant Energy Ormond Beach generating station NPDES, 2001.



Pacific Daylight Time				Tuesday		July 24, 2001	
Time	Height	Time	Height	Time	Height	Time	Height
0010	5.9'	0714	-0.5'	1344	4.7'	1923	1.9'

Figure 6. Tidal rhythms during water quality sampling, summer survey. Reliant Energy Ormond Beach generating station NPDES, 2001.

Sediment cores were collected by biologist-divers at Stations B1 through B6 for infaunal analysis, sediment grain size, and sediment chemistry on 25 July between 1110 and 1400 hr. Skies were mostly cloudy to overcast and winds were from the west to northwest at 2 to 8 kn. The swell was out of the west at 1 to 2 ft during sediment sampling.

On 19 October, mussels were collected by biologist-divers from the discharge buoy and returned to the laboratory for analysis.

During the winter survey, no plankton blooms (red tide), floatables, oil, or grease were observed at any of the stations. The water was turbid at Station RW6 due to breaking surf and riptides. Drift wood or drift algae were seen at most stations. Western gulls (*Larus occidentalis*) were seen throughout the study area. Other less common birds present were: a Heermann's gull (*Larus heermanni*) at Station RW3; a Caspian tern (*Sterna caspia*) at Station RW2; western grebes (*Aechmophorus occidentalis*) at Station RW2; and a cormorant (*Phalacrocorax* sp.) at Station RW8. A California sea lion (*Zalophus californianus*) was seen at Stations RW3. One California brown pelican (*Pelecanus occidentalis californicus*) was seen at Station RW9. No California least terns (*Sterna antillarum browni*) were seen during the winter survey.

During the summer surveys no oil, grease, or floatables were observed at any of the stations. The water was turbid at most water quality stations during flood tide sampling, at RW7 and RW9 during ebb tide, and at Station B5. During benthic sampling a plankton bloom was present at Station B5. Western gulls were observed at Stations RW5, RW6, and B3, and a Heermann's gull was observed at Station B4. Caspian terns were seen at Stations RW4, RW5, and B5; and a double-crested cormorant (*Phalacrocorax auritus*) was seen at Station B5. Common dolphins (*Delphinus delphis*) were seen at Station RW6. California brown pelicans were seen at Stations RW4, RW7, RW8, and B6. California least terns were seen at Stations B3 and B6.

WATER COLUMN MONITORING

Receiving water monitoring stations are shown in Figure 3. Water quality data for winter and summer ebb and flood tide sampling are provided in Figures 7 through 10 and Table 2. Raw data are presented in Appendix C.

Temperature

In winter, flood tide surface water temperature averaged 14.82°C with values ranging from 13.89°C at upcoast Station RW9 to 15.81°C at Station RW3, located at the discharge (Table 2 and Figure 7). Surface temperature during ebb tide averaged 14.63°C and ranged from 14.29°C at Station RW2, upcoast of the discharge, to 16.44°C at Station RW4, downcoast of the discharge. During flood tide, warmer surface waters were observed at Stations RW1 through RW5. Waters were nearly isothermal from surface to bottom during ebb tide, except at Station RW4, where a lens of warm water was present in the upper four meters of the water column. Lowest near-bottom temperatures, 12.51°C during flood tide and 13.13°C during ebb tide, were recorded at Station RW7, the deepest station. Highest near-bottom temperatures were 13.57 during flood tide at Station RW6, the shallowest station, and 14.31°C during ebb tide at upcoast Station RW9. Maximum surface-to-bottom temperature differentials occurred at Station RW3 during flood tide (2.88°C) and at Station RW4 during ebb tide (2.16°C).

Table 2. Summary water quality parameters during ebb and flood tides. Reliant Energy Ormond Beach generating station NPDES, 2001.

	Temp. (°C)		D.O. (mg/l)		pH		Salinity (ppt)		Temp. (°C)		D.O. (mg/l)		pH		Salinity (ppt)	
								Winter								
				Surface									Bottom			
	ebb	flood	ebb	flood	ebb	flood	ebb	flood	ebb	flood	ebb	flood	ebb	flood	ebb	flood
Mean	14.63	14.82	8.29	7.92	7.99	7.95	33.34	33.39	14.00	12.91	8.17	7.26	7.99	7.91	33.38	33.46
Minimum	14.29	13.89	8.16	7.33	7.98	7.91	33.24	33.35	13.13	12.51	7.56	6.93	7.93	7.88	33.35	33.33
Maximum	16.44	15.81	8.43	8.33	8.01	7.99	33.37	33.43	14.31	13.57	8.41	7.53	8.01	7.93	33.45	33.53
								Summer								
				Surface									Bottom			
	ebb	flood	ebb	flood	ebb	flood	ebb	flood	ebb	flood	ebb	flood	ebb	flood	ebb	flood
Mean	16.97	15.23	9.10	7.30	8.13	7.95	33.48	33.49	14.41	12.65	8.29	6.84	7.98	7.89	33.55	33.54
Minimum	15.53	14.38	8.13	6.55	8.06	7.86	33.40	33.45	12.67	12.47	7.28	6.70	7.88	7.86	33.52	33.51
Maximum	19.00	16.07	10.38	7.76	8.21	8.03	33.50	33.52	15.49	12.84	9.03	7.12	8.05	7.89	33.62	33.57

In summer, surface water temperature averaged 15.23°C during flood tide and 16.97°C during ebb tide (Table 2 and Figure 7). During flood tide, surface temperature ranged from 14.38°C at Station RW9 to 16.07°C at Station RW4. During ebb tide, surface temperature ranged from 15.53°C at Station RW7 to 19.00°C at Station RW3. Surface temperatures during both tides were highest at Stations RW3, RW4, and RW6. At all stations, temperatures throughout the water column were higher during the afternoon ebb tide than during flood tide. During both tidal stages, temperatures decreased from surface to bottom at all receiving water stations. Thermoclines were observed in the upper three to five meters of the water column at Stations RW3 through RW6 during both tides. During flood tide, near-bottom temperatures ranged from 12.47°C at Station RW7 to 12.84°C at Station RW6. Ebb tide near-bottom temperatures ranged from 12.67°C at Station RW8, downcoast of the discharge, to 15.49°C at Station RW6. Maximum surface-to-bottom temperature differentials occurred at discharge Station RW3 during ebb tide (4.49°C) and Station RW4 during flood tide (3.47°C).

Dissolved Oxygen

In winter, surface dissolved oxygen (DO) concentration during flood tide averaged 7.92 mg/l and ranged from 7.33 mg/l at Station RW3 to 8.33 mg/l at Station RW5, downcoast of the discharge (Table 2 and Figure 8). During ebb tide, surface DO averaged 8.29 mg/l and ranged narrowly from 8.16 mg/l at Station RW4 to 8.43 mg/l at Station RW6. Dissolved oxygen concentrations throughout the water column were slightly higher during ebb tide than during flood tide, except at Stations RW5 and RW8, where DO values were similar between tides. In general, DO values changed little with depth, though slight midwater increases in DO were apparent at Stations RW1 through RW4. Maximum surface-to-bottom DO differentials were 1.30 mg/l during flood tide and 0.77 mg/l during ebb tide, both occurring at Station RW8. Near-bottom DO values averaged 7.26 mg/l during flood tide and 8.17 during ebb tide.

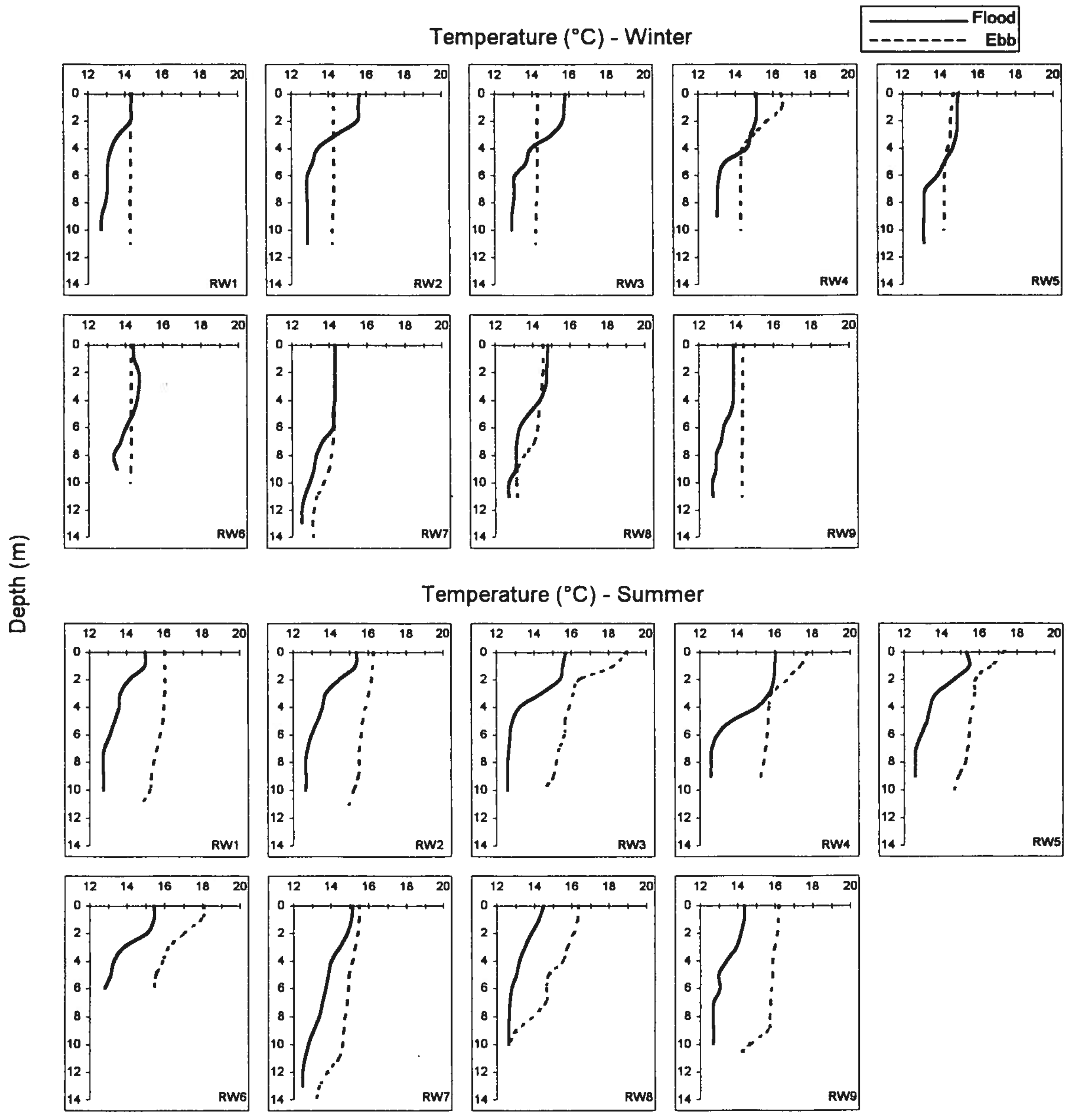


Figure 7. Temperature vertical profiles during ebb and flood tides. Reliant Energy Ormond Beach generating station NPDES, 2001.

In summer, surface DO concentrations during flood tide averaged 7.30 mg/l and ranged from 6.55 mg/l at Station RW3 to 7.76 mg/l at Station RW5 (Table 2 and Figure 8). During ebb tide, surface DO averaged 9.10 mg/l and ranged from 8.13 mg/l at Station RW7 to 10.38 mg/l at Station RW2. Dissolved oxygen concentrations throughout the water column were somewhat higher (0.5 to 3.1 mg/l) during ebb tide than during flood tide. As in winter, DO concentrations varied little from surface to bottom, and mid-water maxima were recorded at several station during both tides. Maximum surface-to-bottom DO differentials occurred at Station RW5 during flood tide (1.03 mg/l) and at Station RW8 during ebb tide (2.49 mg/l). During flood tide, near-bottom DO values averaged 6.84 mg/l, while during ebb tide they averaged 8.29 mg/l.

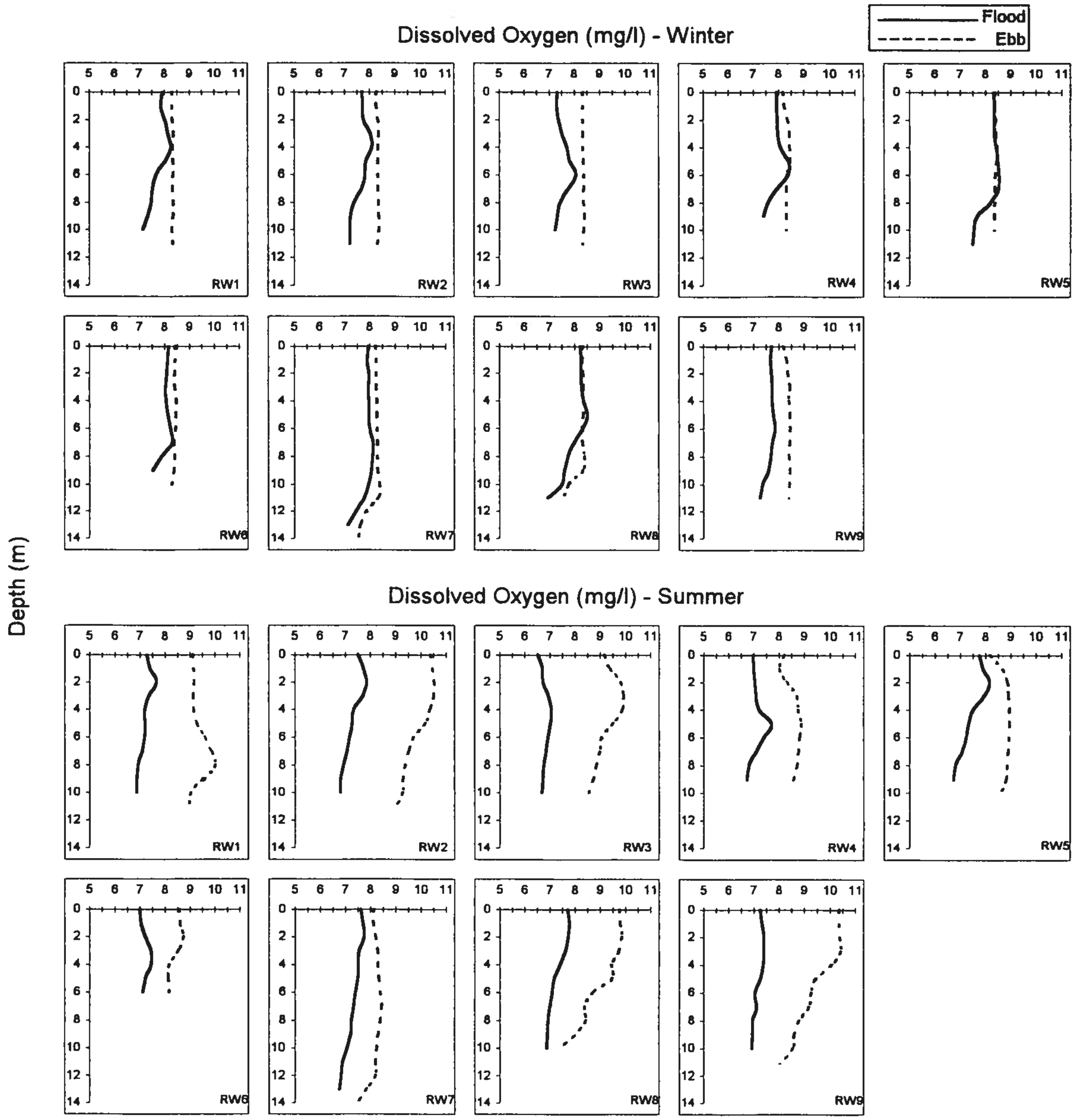


Figure 8. Dissolved oxygen vertical profiles during ebb and flood tides. Reliant Energy Ormond Beach generating station NPDES, 2001.

Hydrogen Ion Concentration (Ph)

In winter, surface hydrogen ion concentration (pH) averaged 7.95 during flood tide and 7.99 during ebb tide (Table 2 and Figure 9). Profiles were near-vertical at all stations during both tides, with a maximum surface-to-bottom pH differential of 0.09 at Station RW8 during flood tide and 0.06 at Stations RW7 and RW8 during ebb tide. Near-bottom pH values averaged 7.91 during flood tide and 7.99 during ebb tide.

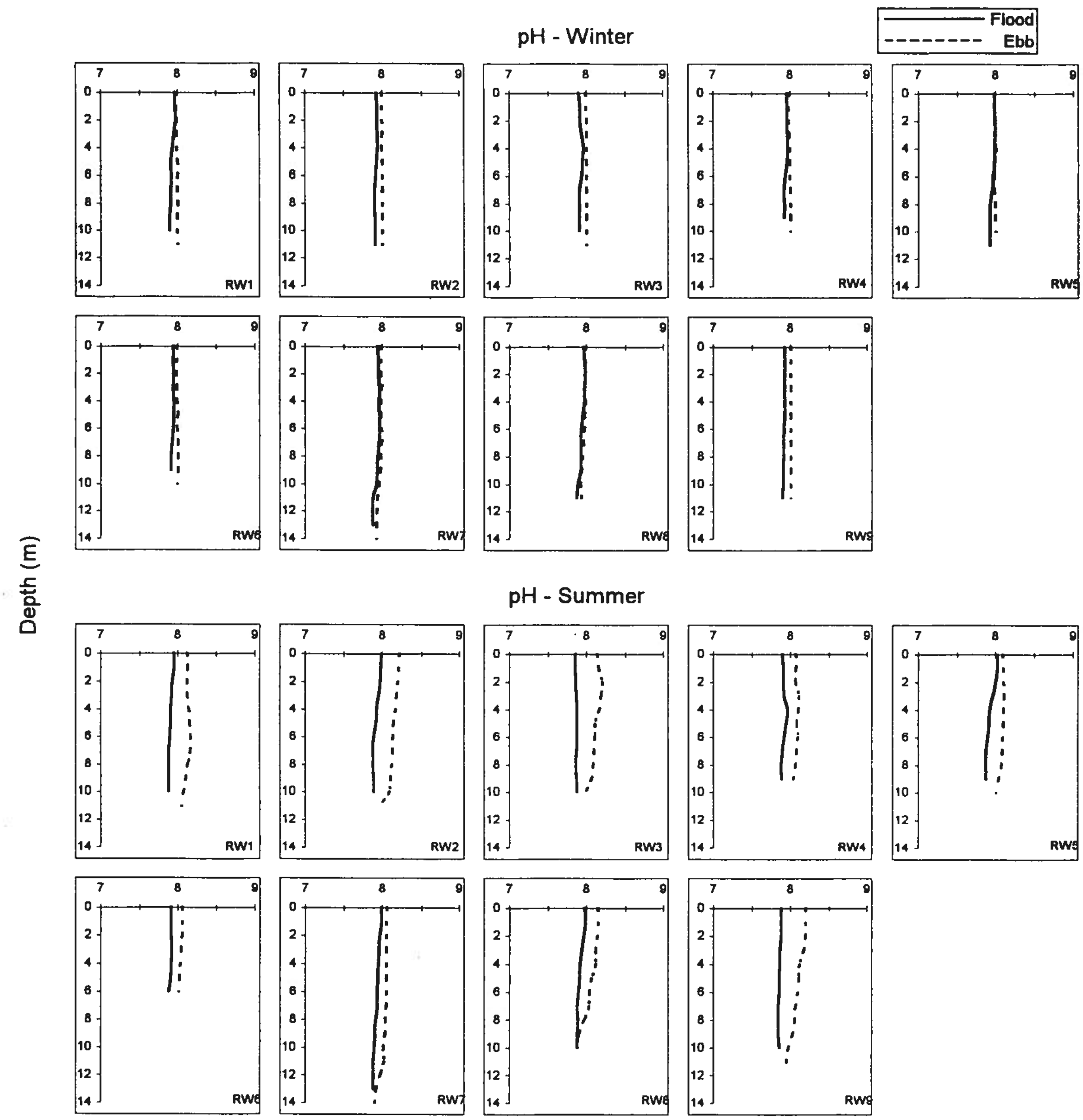


Figure 9. Hydrogen ion concentration (pH) vertical profiles during ebb and flood tides. Reliant Energy Ormond Beach generating station NPDES, 2001.

Surface pH in summer averaged 7.95 during flood tide and 8.13 during ebb tide (Table 2 and Figure 9). Hydrogen ion values throughout the water column at all stations were slightly higher during afternoon flood tide sampling. Near-bottom pH values averaged 7.89 during flood tide and 7.98 during ebb tide. Maximum surface-to-bottom pH differentials were recorded at Station RW5 during flood tide (0.14) and Station RW8 during ebb tide (0.27).

Salinity

In winter, surface salinity averaged 33.39 parts per thousand (ppt) during flood tide and 33.34 ppt during ebb tide (Table 2 and Figure 10). Salinity profiles were near-vertical at all stations during both tides, though distinct mid-water salinity increases were recorded at Stations RW2, RW4, and RW8 during flood tide. Bottom salinity averaged 33.46 ppt during flood tide and 33.38 ppt during ebb tide.

In summer, surface salinity averaged 33.49 ppt during flood tide and 33.48 ppt during ebb tide (Table 2 and Figure 10). Salinity fluctuated slightly from surface to bottom at most stations, and mid-water salinity maxima were recorded at several stations during both tides. The most distinct mid-water increases were noted at Stations RW2, RW3, and RW6 during flood tide. Bottom salinity averaged 33.54 during flood tide and 33.55 during ebb tide.

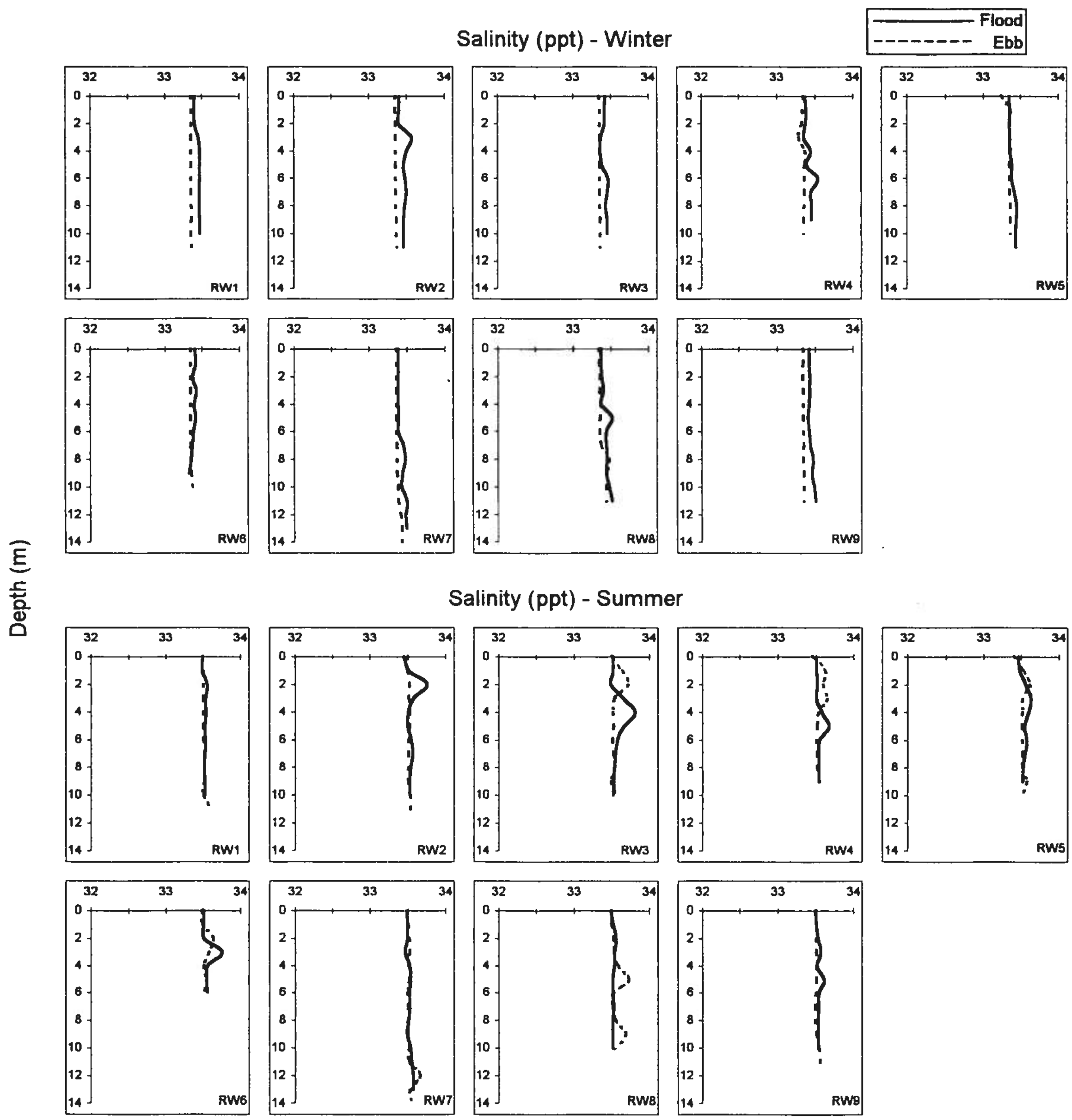


Figure 10. Salinity vertical profiles during ebb and flood tides. Reliant Energy Ormond Beach generating station NPDES, 2001.

SEDIMENT MONITORING

Sediment Grain Size

Sediment distribution curves and parameters describing sediment grain size characteristics at each station are presented in Appendix D and summarized in Table 3. Grain size is expressed in phi (Φ) units, which are inversely related to grain diameter (Appendix B).

Table 3. Sediment grain size parameters. Reliant Energy Ormond Beach generating station NPDES, 2001.

	Station							
Parameter	B1	B2	B3	B4	B5	B6	Mean	S.D.
% Gravel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
% Sand	86.36	91.91	82.61	88.59	90.64	94.47	89.10	4.22
% Silt	10.98	6.71	14.79	9.53	7.75	4.53	9.05	3.59
% Clay	2.66	1.38	2.60	1.88	1.61	1.00	1.86	0.67
Mean grain size								
phi	3.06	2.60	3.39	3.30	2.91	3.01	3.02	0.28
µm	120	165	95	102	133	124	123.2	24.9
Sorting(ϕ)	1.25	1.24	0.94	0.66	0.87	0.59	0.92	0.28
Skewness	-0.04	-0.34	0.14	0.03	-0.01	0.01	-0.03	0.16
Kurtosis	1.97	0.97	1.94	1.35	1.12	1.15	1.42	0.44

Sediments in the study area in 2001 were composed primarily of sand, with smaller amounts of silt and clay (Table 3). Overall, sediments from the six stations averaged about 89% sand, 9% silt, and almost 2% clay, with an average mean grain size of 3.02 phi (123 µm, very fine sand). Sediments were finest at the discharge (Station B3), where mean grain size was 3.39 phi (95 µm, very fine sand). Coarsest sediments were collected from Station B2, 1,000 ft upcoast from the discharge, where mean grain size was 2.60 phi (165 µm, fine sand).

Sorting, a measure of the spread of the particle distribution curve, averaged 0.92 phi overall, representing moderately sorted sediments (Table 3). Sorting values ranged from 0.59 phi (moderately well sorted) at Station B6 to 1.25 phi (poorly sorted) at Station B1. Poorly sorted sediments are composed of a broad range of particle size classes, while well sorted sediments contain fewer size classes.

Skewness and kurtosis tell how closely the grain size distribution approaches the normal Gaussian probability curve. More extreme skewness and kurtosis values indicate non-normal distributions. Skewness is a measure of the symmetry of the particle distribution curve; a value of zero indicates a symmetrical distribution of fine and coarse materials around the mode of the curve, while a value greater then zero (positive) indicates an excess of fine material, and a negative value indicates an excess of coarse material. At four stations, skewness ranged from -0.04 to 0.03, indicating near-normal distributions (Table 3). However, skewness at Station B3 (0.14) indicating a curve skewed toward finer material, while skewness at Station B2 (-0.34) indicated a curve skewed toward coarser material.

Kurtosis is a measure of the peakedness of the particle distribution curve. A kurtosis value of 1.0 represents a normal particle distribution curve. Kurtosis values at most stations in 2001 were greater than 1.0, indicating leptokurtic (excessively peaked) distributions, with dominance by a narrow range of size classes (Table 3). Kurtosis at Station B2 (0.97) indicated a platykurtic (flattened) distribution. Kurtosis was greatest at Stations B1 and B3.

Sediment Chemistry

Sediment samples collected at the six benthic stations were analyzed for chromium, copper, nickel, and zinc. Values are reported as dry weight. Metal concentrations were similar among stations. The highest concentrations of chromium, copper, and zinc were detected at Station B5, 3,000 ft downcoast from the discharge (Table 4 and Appendix E). Nickel concentration was highest at Station B4, 1,000 ft downcoast from the discharge. Lowest concentrations of copper, nickel, and zinc were detected at the discharge (Station B3), while lowest chromium concentration was recorded at Station B6, inshore of the discharge.

Table 4. Sediment metal concentrations (mg/dry kg). Reliant Energy Ormond Beach generating station NPDES, 2001.

	Station						Overall			Detection
Metal	B1	B2	B3	B4	B5	B6	Mean	S.D.	ERL	Level
Chromium	13	12.0	9.9	14	15	9.6	12.3	2.2	81	1.4 - 1.6
Copper	4.3	4.0	3.5	4.5	6.4	3.8	4.4	1.0	34	1.4 - 1.6
Nickel	8.8	8.0	6.9	9.5	8.6	7.4	8.2	1.0	21	1.4 - 1.6
Zinc	20	19	16	23	26	21	21	3.4	150	6.9 - 8.0

ERL = Effects Range Low

Chromium. Sediment chromium concentrations averaged 12.3 mg/kg and ranged from 9.6 mg/kg at Station B6 to 15 mg/kg at Station B5 (Table 4).

Copper. Sediment copper concentrations averaged 4.4 mg/kg and ranged from 3.5 mg/kg at Station B3 to 6.4 mg/kg at Station B5 (Table 4).

Nickel. Sediment nickel concentrations averaged 8.2 mg/kg and ranged from 6.9 mg/kg at Station B3 to 9.5 mg/kg at Station B5 (Table 4).

Zinc. Sediment zinc concentrations averaged 21 mg/kg and ranged from 16 mg/kg at Station B3 to 26 mg/kg at Station B5 (Table 4).

MUSSEL BIOACCUMULATION

Bay mussels (*Mytilus edulis*) were collected near Ormond Beach generating station's discharge in summer 2001 to determine whether selected heavy metals were being bioaccumulated by the mussel's tissues. The 45 mussels collected were divided into three groups and batched for tissue analysis. Results of the analysis are summarized in Table 5 and presented as mg/dry kg dry weight.

Copper and zinc were detected in all mussel tissue replicates from the Ormond Beach generating station discharge (Table 5, Appendix F). Chromium and nickel were not detected in any mussel replicate at Ormond Beach or at the two reference locations. Mean zinc concentration was 107.7 mg/dry kg and mean copper was 8.0 mg/dry kg. Copper and Zinc were also detected at two reference sites. At the Manhattan Beach Pier, mean zinc concentration in bay mussels was 53.7 mg/dry kg, while mean copper was 3.7 mg/dry kg. Zinc concentration at the pier ranged from 45 to 68 mg/dry kg, while copper ranged from N.D. to 5.7 mg/dry kg. At the second reference site, located on the west end of Catalina Island at Johnson's Rock, zinc and copper were also detected in the replicate mussel tissue samples. At the Catalina Island site, mean zinc concentration in bay mussels was 230 mg/dry kg, while mean copper was 15 mg/dry kg. Zinc concentration ranged from 170 to 270 mg/dry kg, while copper ranged from 13 to 16 mg/dry kg.

Table 5. Bay mussel tissue metal concentrations (mg/dry kg). Reliant Energy Ormond Beach generating station NPDES, 2001.

Metal	Replicate 1	Replicate 2	Replicate 3	Mean	S.D.	ERL	Detection Limit
Discharge							
Chromium	ND	ND	ND	ND	-	81	5.5 - 6.3
Copper	8.7	7.0	8.3	8.0	0.9	34	5.5 - 6.3
Nickel	ND	ND	ND	ND	-	21	5.5 - 6.3
Zinc	77	96	150	107.7	37.9	150	28 - 32
Pier Reference Site (Manhattan Beach Pier)							
Chromium	ND	ND	ND	ND	-	81	4.5 - 5.2
Copper	ND	5.3	5.7	3.7	3.2	34	4.5 - 5.2
Nickel	ND	ND	ND	ND	-	21	4.5 - 5.2
Zinc	45	68	48	53.7	12.5	150	23 - 26
Catalina (west end) Reference Site							
Chromium	ND	ND	ND	ND	-	81	7.4 - 9.5
Copper	13	16	16	15.0	1.7	34	7.4 - 9.5
Nickel	ND	ND	ND	ND	-	21	7.4 - 9.5
Zinc	270	170	250	230.0	52.9	150	170 - 270

ND = Below the detection limit (for calculations ND = 0)
ERL = Effects Range Low

BIOLOGICAL MONITORING

Benthic Infauna

Results of the 2001 benthic infauna sampling are presented by station in Appendix G. Data are summarized in Tables 6, 7, and 8 and Figure 11.

Species Composition. A total of 3,311 individuals in 174 species (or other taxonomic category) and 12 phyla (major groups) were taken in the 2001 benthic infauna sampling off the Ormond Beach generating station (Table 6). Annelids were the most diverse phylum, with 72 species (41%) of the total, followed by arthropods with 47 species (27%), and mollusks with 28 species (16%). Each of the remaining nine phyla was represented by far fewer species, with just under 5% to less than 1% of the total species. The three dominant phyla were also the most diverse groups at each of the six stations, although annelids and arthropods were equally speciose at Station B6, inshore of the discharge. More than twice as many annelid species occurred at each of Stations B1 (farthest upcoast), B3 (at the discharge), and B5 (farthest downcoast) as at Station B6.

In addition to being most diverse, annelids were also the most abundant phylum, with 56% of the individuals taken in the survey (Table 6). Arthropods were second with more than 18% of the individuals. Echinoderms, mollusks, and nemertean worms next most abundant, with 11%, 8%, and 4% of the total abundance, respectively. Each of the seven remaining phyla comprised less than 1% of the abundance. Among the six stations, the abundance differed by phylum, however. Annelids were most abundant at each station, but arthropods were second most abundant at only four of the stations, with echinoderms second in abundance at two stations (Stations B5 and B6).

Abundance. Abundance averaged 552 individuals per station (13,808 individuals/m^2) and ranged from 309 individuals at Station B5 to 1,223 individuals at Station B6 (Table 7). The number of individuals at Station B6 was more than twice that at any other stations.

Species Richness. Species richness averaged 73 species per station, and ranged from 53 species at Station B6 to 85 species at Station B3 (Table 7).

Species Diversity. Shannon-Wiener species diversity (H') averaged 3.13 per station, and ranged from 1.54 at Station B6 to 3.64 at Station B2, immediately upcoast of the discharge (Table 7). Values at all stations except Station B6 were above 3.27.

Table 6. Number of infaunal species and individuals by phylum. Reliant Energy Ormond Beach generating station NPDES, 2001.

	Station								Percent
Parameter	B1	B2	B3	B4	B5	B6	Total	Mean	Total
Number of species									
Annelida	36	26	37	25	35	15	72	29.0	41.4
Arthropoda	18	21	25	22	18	15	47	19.8	27.0
Mollusca	11	14	11	13	10	9	28	11.3	16.1
Nemertea	6	5	5	3	4	5	8	4.7	4.6
Echinodermata	2	1	2	2	4	3	5	2.3	2.9
Cnidaria	-	3	-	1	2	2	4	1.3	2.3
Platyhelminthes	1	-	1	-	-	1	3	0.5	1.7
Phorona	2	2	2	1	1	1	2	1.5	1.1
Sipuncula	-	2	1	1	1	-	2	0.8	1.1
Brachiopoda	1	-	-	-	-	-	1	0.2	0.6
Chordata	1	1	1	1	1	1	1	1.0	0.6
Nematoda	1	1	-	-	1	1	1	0.7	0.6
Total	79	76	85	69	77	53	174	73.2	
Number of individuals									
Annelida	255	133	242	140	115	972	1857	309.5	56.1
Arthropoda	127	91	128	127	51	87	611	101.8	18.5
Echinodermata	8	35	68	94	59	105	369	61.5	11.1
Mollusca	28	48	41	91	43	18	269	44.8	8.1
Nemertea	8	23	24	19	21	33	128	21.3	3.9
Phorona	5	6	5	2	6	1	25	4.2	0.8
Chordata	1	2	3	5	7	2	20	3.3	0.6
Cnidaria	-	8	-	2	4	2	16	2.7	0.5
Nematoda	1	1	-	-	2	2	6	1.0	0.2
Sipuncula	-	2	1	1	1	-	5	0.8	0.2
Platyhelminthes	1	-	1	-	-	1	3	0.5	0.1
Brachiopoda	2	-	-	-	-	-	2	0.3	0.1
Total	436	349	513	481	309	1223	3311	551.8	

Table 7. Infaunal community parameters. Reliant Energy Ormond Beach generating station NPDES, 2001.

	Station							
Parameter	B1	B2	B3	B4	B5	B6	Total	Mean
Number of species								
Total	79	76	85	69	77	53	174	73.2
Rep. Mean	30.0	34.3	37.3	32.8	33.3	28.3		
Rep. S.D.	16.0	10.0	8.4	9.4	7.2	1.0		
Number of individuals								
Total	436	349	513	481	309	1223	3311	551.8
Rep. Mean	109.0	87.3	128.8	120.3	77.3	305.8		138.1
Rep. S.D.	114.9	42.6	23.1	73.3	22.6	48.8		
Density (Number/m^2)								13808
Diversity (H')								
Total	3.27	3.64	3.46	3.28	3.58	1.54	3.28	3.13
Rep. Mean	2.64	3.11	2.93	2.80	3.08	1.40		
Rep. S.D.	0.27	0.19	0.27	0.13	0.24	0.18		
Biomass (g)								
Total	1.76	0.93	5.23	1.37	5.42	1.91	16.63	2.77
Rep. Mean	0.44	0.23	1.31	0.34	1.36	0.48		0.69
Rep. S.D.	0.42	0.10	1.22	0.25	1.33	0.32		

Biomass. Infauna biomass totaled 16.6 g for the survey and averaged less than 3 g per station (690 g/m²) (Table 7). Biomass ranged from 0.9 g at Station B2 to 5.42 g at Station B5. Echinoderms comprised 55% the biomass, due to the presence of a few large brittlestars (Appendix G-4).

Community Composition. Seventeen species each comprised 1% or more of the all individuals collected and together totaled 76% of the infauna collection (Table 8). The annelid *Apoprionospio pygmaea* was the most abundant species, with almost 29% of the abundance, but among the six stations it was the most abundant species only at Station B6, where it comprised 65% of the individuals (Appendix G-3). This species was almost three times as abundant as the next most abundant species, Pacific sand dollar (*Dendraster excentricus*), which comprised 11% of the total. Pacific sand dollars were also more abundant at Station B6 than elsewhere. The annelids *Armandia brevis*, *Owenia collaris*, and *Mediomastus acutus* were also abundant (10%, 3%, and 3%, respectively), as were the cumacean arthropod *Diastylopsis tenuis* (4%) and the clam *Tellina modesta* (3%). Most of these abundant species occurred at all of the stations, and all of the top 17 species occurred at both Station B2 and Station B3. Species which were less abundant were less likely to occur at all stations (Appendix G-2).

Cluster Analyses. The 17 most abundant species were used for the normal (site-group) and inverse (species-group) cluster analyses (Figure 11). The six stations separated into three groups, based on the relative abundances of the 17 species. The communities at Stations B2 and B5, comprising Group I, were most similar. Those at Stations B3 and B4, immediately downcoast of the discharge (in Group II) were next most similar to each other, but only slightly less so than those the previous group. The community at Station B1 was more similar to those at Stations B3 and B4 than to other communities, and clustered with those stations in Group II. Station B6 (Group III) clustered most distantly from the other five stations; the community at this station was most unlike those at the other stations, with higher abundances of four of the top species than occurred elsewhere. Overall, however, the six stations clustered relatively close to each other.

Table 8. The 17 most abundant infaunal species. Reliant Energy Ormond Beach generating station NPDES, 2001.

		Station							Percent	Cum.
Phylum	Species	B1	B2	B3	B4	B5	B6	Total	Total	Percent
AN	*Apoprionospio pygmaea*	58	21	27	28	20	794	948	28.62	28.6
EC	*Dendraster excentricus*	7	35	67	93	55	103	360	10.87	39.5
AN	*Armandia brevis*	90	3	85	4	-	142	324	9.78	49.3
AR	*Diastylopsis tenuis*	23	29	12	55	12	6	137	4.14	53.4
AN	*Owenia collaris*	25	38	25	14	3	6	111	3.35	56.8
MO	*Tellina modesta*	15	17	14	48	10	2	106	3.20	60.0
AN	*Mediomastus acutus*	25	10	20	18	21	-	94	2.84	62.8
AR	*Rhepoxynius abronius*	8	2	31	12	5	7	65	1.96	64.8
AR	*Aoroides inermis*	30	2	19	8	-	1	60	1.81	66.6
NE	*Carinoma mutabilis*	1	10	10	11	11	11	54	1.63	68.2
AR	*Rhepoxynius menziesi*	13	3	17	8	3	4	48	1.45	69.7
MO	*Rochefortia tumida*	1	3	8	12	20	1	45	1.36	71.0
AN	*Aricidea (Acmira) catherinae*	3	12	12	6	6	-	39	1.18	72.2
AR	*Lamprops carinatus*	-	3	4	5	-	27	39	1.18	73.4
AR	*Gibberosus myersi*	10	16	3	-	8	-	37	1.12	74.5
MO	*Mactromeris catilliformis*	3	8	4	12	6	2	35	1.06	75.5
AN	*Spiophanes bombyx*	4	7	7	7	6	2	33	1.00	76.5

AN = Annelida; EC = Echinodermata; AR = Arthropoda; MO = Mollusca; NE = Nemertea

The most abundant species clustered into three groups, based on their occurrences (Figure 11). Species Group A contains the species which were most evenly distributed among the stations, especially the stations in Groups I and II. Species Groups B and C include the three overall most abundant species and the 14th most abundant species, the cumacean *Lamprops carinatus*. These four species were much more abundant at Station B6 than elsewhere. Both *L. carinatus* and

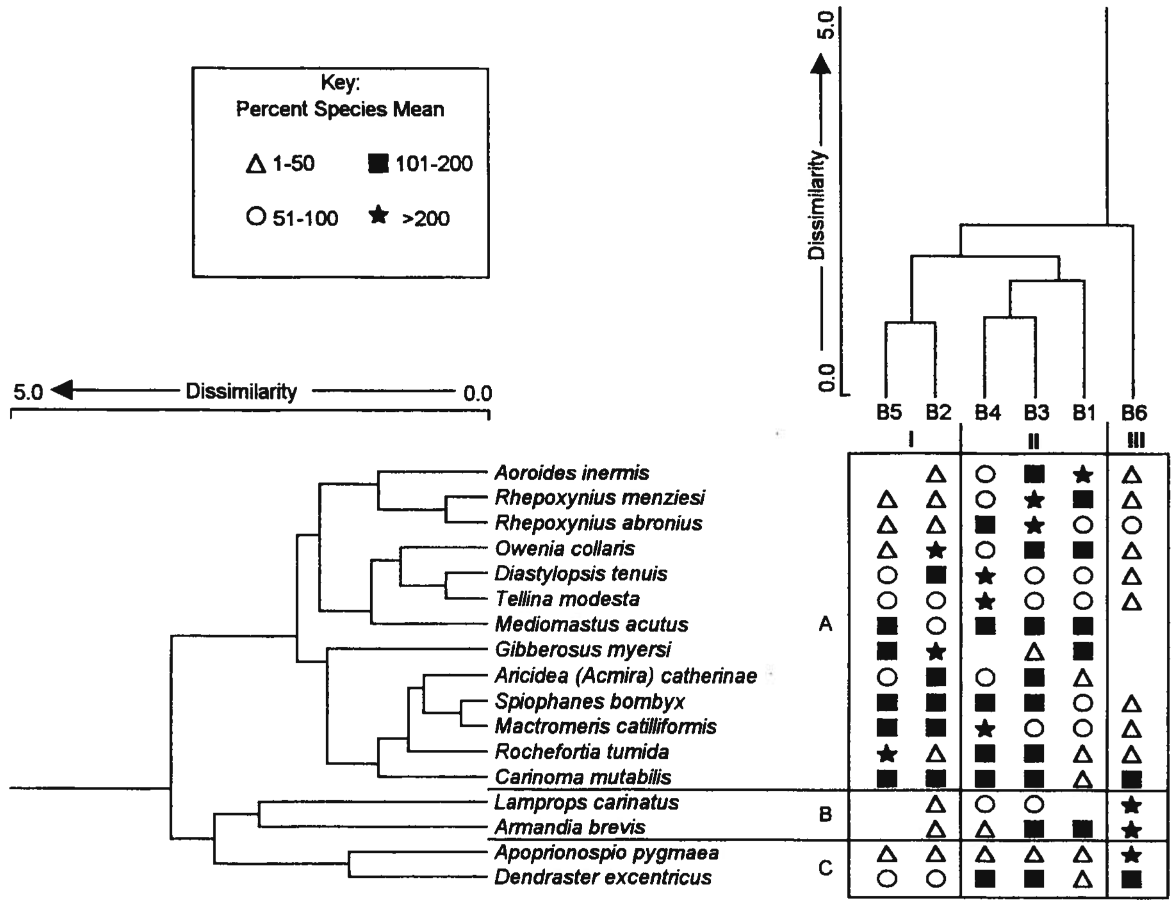


Figure 11. Two-way coincidence table resulting from normal (station) and inverse (species) classification dendrograms for the 17 most abundant infauna species. Reliant Energy Ormond Beach generating station NPDES, 2001.

Armandia brevis (Species Group B) were absent from Station B5, while *Apoprionospio pygmaea* and Pacific sand dollar (Species Group C) were present everywhere

. Impingement

The results of heat treatment and normal operation fish impingement sampling at the Ormond Beach generating station for the sample year 2001 (1 October 2000 to 30 September 2001) are presented in their entirety in Appendix H. Tables and figures of fish and macroinvertebrate data from the nine heat treatments and 12 normal operation surveys are presented separately in the following text.

Fish

Species Composition. The combined heat treatment and normal operation surveys yielded at least 47 species of fish, representing two classes and 29 families (Appendix H-1). Five families of cartilaginous (Elasmobranchiomorphi = Chondrichthyes) and 24 families of bony fish (Osteichthyes) were dominated by nine species of surfperch from the family Embiotocidae and four species of croakers from the family Sciaenidae.

Abundance. Combined heat treatment and normal operation impingement catches yielded an estimated 15,583 individuals (Table 9). The nine heat treatment catches yielded 3,380 individuals comprising at least 39 species. The catch per heat treatment averaged 375.6 individuals and 12.3 species, and ranged from 23 individuals and six species on 27 May 2001 to 1,454 individuals on 28 October 2000 and 18 species on both 28 October 2000 and 21 June 2001 (Table 10).

Table 9. Combined heat treatment and extrapolated normal operation abundance and percent total of the 10 most abundant fish species. Reliant Energy Ormond Beach generating station NPDES, 2001.

Species	Heat Treatment		Extrapolated Normal Operations*		Overall		Cumulative
	Abundance	Percent	Abundance	Percent	Abundance	Percent	Percent
barred surfperch	47	1.4	3283	26.9	3330	21.4	21.4
topsmelt	123	3.6	1740	14.3	1863	12.0	33.3
queenfish	1523	45.1	73	0.6	1596	10.2	43.6
speckled sanddab	-	-	1330	10.9	1330	8.5	52.1
northern anchovy	518	15.3	626	5.1	1144	7.3	59.4
shiner perch	94	2.8	851	7.0	945	6.1	65.5
white croaker	1	0.0	738	6.0	739	4.7	70.2
walleye surfperch	611	18.1	-	-	611	3.9	74.2
Pacific staghorn sculpin	1	0.0	563	4.6	564	3.6	77.8
bat ray	2	0.1	462	3.8	464	3.0	80.8
Survey totals							
Number of individuals	3380		12203		15583		
Number of species	39		28		47		

* Extrapolations based on flow during month sampled divided by flow on date sampled, times abundance on sampling date; 12 days sampled during year, totaling 3.23% of the annual circulation through plant.

An estimated 12,203 fish and at least 28 species were taken in normal operation impingement surveys. Normal operations yielded 78.3% of the fish impinged, whereas 21.7% were taken during heat treatments .

Table 10. Number of species, number of individuals, and biomass (kg) of fish impinged during heat treatments. Reliant Energy Ormond Beach generating station NPDES, 2001.

Date	Number Species	Number Individuals	Biomass
28 Oct 00	18	1454	42.16
4 Nov 00	10	270	9.89
30 Dec 00	11	388	14.74
22 Feb 01	9	133	29.36
2 May 01	10	62	21.51
27 May 01	6	23	6.85
21 Jun 01	18	369	42.00
18 Aug 01	14	514	49.06
22 Sep 01	15	167	15.78
Total	39	3380	231.34
Mean	12.3	375.6	25.70

The 10 most abundant species overall accounted for 83.3% of all individuals, comprising 87.9% of the abundance during heat treatment surveys and 84.5% during normal operation surveys (Table 9). The most abundant species was Pacific pompano (*Peprilus simillimus*) with 21.5% of all individuals; they accounted for 26.9% of the abundance during normal operation surveys, but only comprised 2.0% during heat treatment surveys. Queenfish (*Seriphus politus*) was second in abundance overall with 20.9%; it was first in abundance during heat treatments (45.1%), and was second in abundance during normal operation surveys (14.3%). Speckled sanddab (*Citharichthys stigmaeus*) was third with 8.5% of the abundance; they were third during normal operations, with 10.9% of the abundance, but none were taken during heat treatments. Northern anchovy (*Engraulis mordax*) ranked fourth with 7.3% of the abundance; it ranked third during heat treatments, accounting for 15.3% of the abundance, and contributed 5.1% during normal operations. Topsmelt (*Atherinops affinis*) was fifth with 6.3% of the total abundance, 7.0% of the normal operation abundance, and 3.6% of the heat treatment total. These five species accounted for 64.6% of the overall abundance. Other highly ranked species included bat ray (*Myliobatis californica*), walleye surfperch (*Hyperprosopon argenteum*), thornback (*Platyrhinoidis triseriata*), shiner perch (*Cymatogaster aggregata*), and Pacific staghorn sculpin (*Leptocottus armatus*) accounting for 4.7%, 3.9%, 3.6%, 3.5%, and 3.0%, respectively. Together, these ten species individually accounted for over 83% of the abundance; the remaining 37 species together comprised less than 17% of the overall abundance.

Of the 47 fish species taken during these surveys, 20 species were common to both normal operation and heat treatment surveys; they accounted for almost 83.2% of all fish taken (Appendix H-2). Of the 47 species taken during fish impingement surveys, 19 were unique to normal operation surveys, while only eight of the species were unique to the heat treatment surveys.

Biomass. Fish biomass totaled 2,687.7 kg in the combined heat treatment and normal operation surveys of 2001 (Table 11, Appendix H-3). Pacific electric ray (*Torpedo californica*) was ranked highest in weight, with 1,016.3 kg, accounting for 37.8% of the total biomass; it comprised 41.2% of the biomass during normal operations, but only 1.9% during heat treatments. Bat ray and thornback were second (28.3%) and third (10.3%) highest in weight, respectively; both of these also ranked highly in normal operations surveys, 30.9% and 11.2%, respectively, while both contributed less than 1% to heat treatment biomass. The other seven species among the highest ranked 10 in biomass were, in descending rank order, barred sand bass (*Paralabrax nebulifer*), Pacific pompano, northern anchovy, queenfish, topsmelt, walleye surfperch, and specklefin midshipman (*Porichthys myriaster*). Together, these ten species contributed 2,474.5 kg (92.1%) of the biomass. The remaining 7.9% of the biomass was contributed by 37 species. Over 91% of the biomass of fish was taken during normal operations (2,456.4 kg), with less than 9% taken during heat treatments (231.3 kg). Biomass averaged 25.7 kg per heat treatment, and ranged from 6.9 kg on 27 May 2001 to 49.1 kg on 18 August 2001 (Table 10).

Table 11. Combined heat treatment and extrapolated normal operation biomass (kg) and percent total of the 10 fish species with the greatest biomass. Reliant Energy Ormond Beach generating station NPDES, 2001.

	Heat Treatment		Extrapolated Normal Operations*		Overall	
Species	Biomass	Percent	Biomass	Percent	Biomass	Percent
Pacific electric ray	4.500	1.9	1011.798	41.2	1016.298	37.8
bat ray	1.329	0.6	759.673	30.9	761.002	28.3
thornback	1.072	0.5	274.631	11.2	275.703	10.3
barred sand bass	104.002	45.0	29.145	1.2	133.147	5.0
Pacific pompano	2.689	1.2	90.923	3.7	93.612	3.5
northern anchovy	12.207	5.3	50.501	2.1	62.708	2.3
queenfish	30.403	13.1	18.397	0.7	48.800	1.8
topsmelt	12.912	5.6	27.171	1.1	40.083	1.5
walleye surfperch	21.827	9.4	-	-	21.827	0.8
specklefin midshipman	1.495	0.6	19.832	0.8	21.327	0.8
Total Biomass	231.339		2456.395		2687.734	

* Extrapolations based on flow during month sampled divided by flow on date sampled, times biomass on sampling date; 12 days sampled during year, totaling 3.23% of the annual circulation through plant.

Population Structure. Standard lengths (mm SL) for a maximum of 200 individuals per species were taken during impingement surveys and were used to construct length-frequency histograms for three of the most abundant species, queenfish, shiner perch, and barred sand bass. The histograms reflect the structure of the population impinged by the generating station over time and not necessarily that of the population offshore.

The histogram for queenfish depicts a bimodal size distribution with peaks at 70 and 130 mm SL (Figure 12). The population ranged from 40 to 170 mm SL, with most individuals between 90 and 140 mm SL.

The histogram for shiner perch depicts a single mode with a peak at 80 mm (Figure 13). The population ranged from 50 to 120 mm SL, with most individuals between 60 and 90 mm SL.

The histogram for barred sand bass depicts a broad size distribution with a peak centered at 220 mm SL (Figure 14). The population ranged from 100 to 410 mm SL, with most individuals between 220 and 320 mm SL.

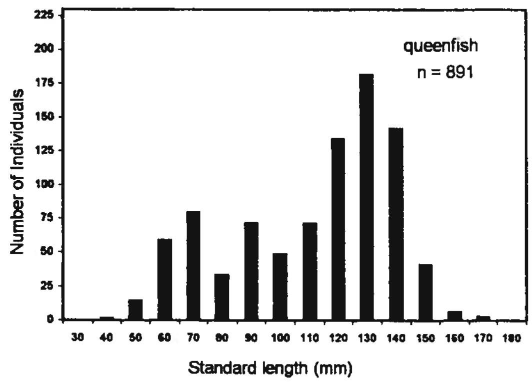


Figure 12. Length-frequency distribution of queenfish (*Seriphus politus*) taken during impingement surveys. Reliant Energy Ormond Beach L.L.C. generating station NPDES, 2001.

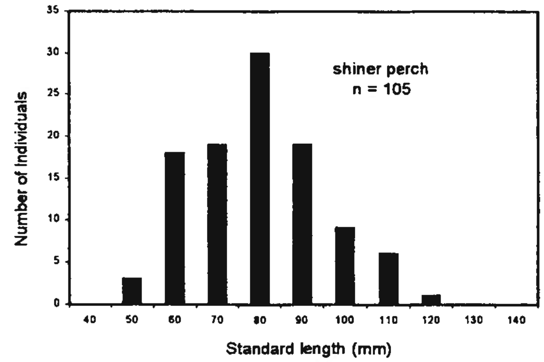


Figure 13. Length-frequency distribution of shiner perch (*Cymatogaster aggregata*) taken during impingement surveys. Reliant Energy Ormond Beach L.L.C. generating station NPDES, 2001.

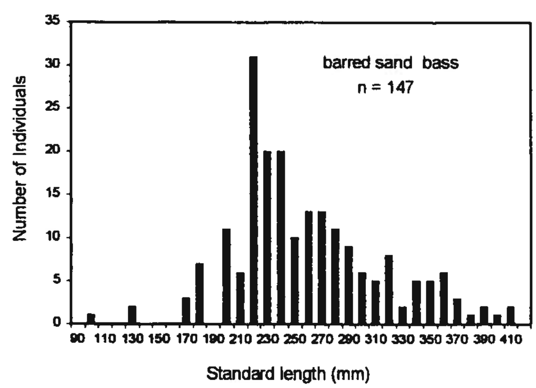


Figure 14. Length-frequency distribution of barred sand bass (*Paralabrax nebulifer*) taken during impingement surveys. Reliant Energy Ormond Beach L.L.C. generating station NPDES, 2001.

Diseases and Abnormalities. No diseases or abnormalities were noted on any fish caught during the impingement surveys.

Macroinvertebrates

In total, at least 19 species of non-fouling macroinvertebrates represented by 11,225 individuals, with a biomass of 261.4 kg, were collected during both heat treatment and normal operation impingement surveys (Table 12). These represented five phyla and 15 families, and included ten species of arthropods (all crustaceans), at least four species of echinoderms, three species of mollusks, and one species each of cnidaria and chordata (Appendix H-1). Greater than 56% of the invertebrate abundance, and 76% of the biomass, was taken during normal operation surveys. Four of the 19 species were common to both heat treatment and normal operation surveys. Nine species were unique to normal operation surveys, while six species were unique to heat treatment surveys.

The Pacific rock crab (*Cancer antennarius*) contributed 50.7% of the abundance, and 37.9% (99.0 kg) of the biomass (Table 12). Blackspotted bay shrimp (*Crangon nigromaculata*) was second in abundance with 27.3% of the total individuals, but ranked sixth in biomass, with 4.9% (12.8 kg) of the total weight. Third in abundance was graceful rock crab (*Cancer gracilis*) with 10.7%; it contributed 4.5% to the biomass. Fourth and fifth in abundance were common salp (*Thetys vagina*) and California market squid (*Loligo opalescens*), accounting for 3.4%, and 2.1% of the abundance, respectively, but they contributed 20.0% (second) and 3.1% to the biomass, respectively. The third and fourth ranked species in biomass were masking crab (*Loxorhynchus crispatus*) with 10.9%, and California spiny lobster (*Panulirus interruptus*) with 6.2%; these two species combined added 2.6%

Table 12. Number of individuals and biomass (kg) of macroinvertebrate species taken during heat treatment and extrapolated normal operations. Reliant Energy Ormond Beach generating station NPDES, 2001.

	Abundance			Percent	Biomass (kg)			Percent
Species	HT	NO	CO	Total	HT	NO	CO	Total
Pacific rock crab	3634	2053	5687	50.7	38.533	60.511	99.04	37.9
graceful rock crab	1201	3060	4261	38.0	11.694	12.823	24.52	9.4
common salp	-	387	387	3.4	-	52.220	52.22	20.0
California market squid	-	232	232	2.1	-	8.135	8.14	3.1
masking crab	14	194	208	1.9	2.044	26.459	28.50	10.9
Xantus swimming crab	-	194	194	1.7	-	2.867	2.87	1.1
California spiny lobster	5	77	82	0.7	1.501	14.721	16.22	6.2
giant keyhole limpet	2	39	41	0.4	0.294	4.687	4.98	1.9
yellowleg shrimp	-	39	39	0.3	-	1.588	1.59	0.6
sea cucumber	-	39	39	0.3	-	15.302	15.30	5.9
California two-spot octopus	27	-	27	0.2	2.331	-	2.33	0.9
sea star	15	-	15	0.1	4.167	-	4.17	1.6
striped shore crab	5	-	5	0.0	0.092	-	0.09	0.0
red rock shrimp	4	-	4	0.0	0.050	-	0.05	0.0
sweet potato sea cucumber	1	-	1	0.0	0.170	-	0.17	0.1
sheep crab	1	-	1	0.0	0.209	-	0.21	0.1
red jellyfish	1	-	1	0.0	0.080	-	0.08	0.0
purple sea urchin	1	-	1	0.0	0.920	-	0.92	0.4
Survey Totals								
Number of individuals	4911	6314	11225					
Number of species	13	10	18					
Biomass					62.085	199.313	261.398	

HT = Heat Treatment, NO = Normal Operation, CO = Combined. 0.0 = < 0.05

* Extrapolation based on flow during month sampled divided by flow on date sampled, times abundance/biomass on sampling date; 12 days sampled during year, totaling 3.23% of the annual circulation through plant.

to the abundance. Together, these seven species accounted for 96.7% of the abundance and 87.5% of the biomass.

DISCUSSION

WATER COLUMN MONITORING

Temperature

Data collected during the winter 2001 NPDES survey at Ormond Beach generating station indicated there was only slight thermal enhancement to the receiving waters in the vicinity of the discharge during both tides. During winter sampling, Ormond Beach generating station was operating two circulating water pumps and discharging water about 12 to 16°C above ambient (Melchor 2002, pers. comm.). (In winter, intake temperature was not available, so a range was estimated by averaging mid-water temperatures at the two control stations on both tides). The generating station was operating in reverse flow during the winter survey, discharging cooling water from the intake structure. Water quality parameters recorded during winter indicated a well-mixed water column, though warm water lenses were noticeable at the surface at several stations during flood tide sampling. During the summer survey, two circulators were operating and the plant was discharging water 14°C above intake temperature (Melchor 2002, pers. comm.). As in winter, warm water lenses were detected at stations near the discharge on both tides in summer. Warmer than ambient surface waters were detected inshore and downcoast of the discharge during both tides. During both winter and summer, temperatures in the upper few meters of the water column at many stations were elevated during afternoon sampling, the result of solar insolation. Cooler near-bottom temperatures in winter and summer during flood tides resulted from the influx of cooler water from offshore on the incoming tide.

Temperatures at all stations in winter and summer were typical for the study area. Mean surface and bottom temperatures in 2001 were similar to those recorded in 2000, warmer than those in 1999, and cooler than temperatures recorded in 1998 (MBC 1998-2000a). In 1999, water temperatures in the Southern California Bight were strongly influenced by a lingering La Niña - a rebound event from the warm water El Niño Southern Oscillation event of 1997-1998 (NOAA 1998). La Niña brought cooler-than-normal waters to the southern California coastline during 1999 (NOAA 1999). All temperatures in 2001 were within ranges documented in previous surveys offshore the generating station (MBC 1979-1981, 1986, 1988, 1990, 1994-2000a; Ogden 1991-1993). As in past surveys, the discharge of warm water from the generating station led to surface lenses of warm water at stations nearest the discharge; however, these temperature elevations were limited to the stations in the immediate vicinity of the discharge. In winter and summer, there was a 2°C temperature differential among the Thermal Plan compliance stations (RW2 and RW4) and the upcoast and downcoast control stations (RW8 and RW9), signifying compliance with the Thermal Plan.

Dissolved Oxygen

The concentration of dissolved oxygen in seawater is affected by physical, chemical, and biological variables. High DO concentrations may result from cool water temperatures (solubility of oxygen in water increases as temperature decreases), active photosynthesis, and/or mixing at the air-water interface (Sverdrup et al. 1942). Conversely, low concentrations may result from warm water temperatures, high rates of organic decomposition, and/or extensive mixing of surface waters with oxygen-poor subsurface waters.

In winter 2001, DO concentrations were fairly uniform throughout the water column during both tidal stages, with mid-water maxima recorded at several stations during flood tide. Higher DO concentrations at all stations during morning ebb tide sampling correspond with cooler water temperatures recorded then. All DO concentrations recorded in winter were within the range of values previously recorded in the study area (MBC 1979-1981, 1986, 1988, 1990, 1994-2000a; Ogden 1991-1993).

In summer, DO levels were substantially higher during afternoon ebb tide sampling, likely the result of increased photosynthesis throughout the day, as ebb tide sampling was done approximately seven hours after flood tide sampling. Concurrent increases in pH further suggest an increase in primary production during ebb tide sampling. Mid-water DO maxima generally occurred just below surface lenses of warmer water. Summer DO concentrations were lower than those recorded in 2000, which were the highest on record in NPDES surveys off the generating station. High DO values last year resulted from a nearshore plankton bloom (MBC 2000a). All concentrations recorded in 2001 were within ranges noted in the study area, and the only detectable effects from the discharge were slight depressions in dissolved oxygen in the upper few meters of the water column resulting from increased surface temperatures.

Hydrogen Ion Concentration

In the open ocean, hydrogen ion concentration (pH) remains fairly constant due to the buffering capacity of seawater (Sverdrup et al. 1942). However, in nearshore areas, pH may be more variable due to physical, chemical, and biological influences. For instance, in areas with large organic influx, such as bays, estuaries, and river mouths, microbial decomposition is greater than in offshore areas. Along with a reduction in dissolved oxygen, decomposition also results in the production of humic acids, which decrease pH (Duxbury and Duxbury 1984). Reduced pH values may also occur in areas of freshwater influx, since freshwater usually has a lower pH than saltwater. In contrast, phytoplankton blooms, which are often associated with nearshore upwelling, may increase pH. High photosynthetic rates increase the removal of carbon dioxide from water, thus reducing the carbonic acid concentration and raising pH.

Hydrogen ion concentrations in winter and summer 2001 were similar to values typically found in the open ocean. Hydrogen ion concentration profiles in winter and summer were near-vertical as pH varied little from surface to bottom. In summer, slightly higher pH values in the study area during the afternoon ebb tide were likely the result of increased primary production. All pH values in winter and summer were well within the range of variation noted in previous surveys in the study area (MBC 1979-1981, 1986, 1988, 1990, 1994-2000a; Ogden 1991-1993).

Salinity

Salinity in the open ocean is generally 35 parts per thousand (ppt); that is, a 1,000-g sample of ocean water contains 35 g of dissolved compounds, collectively referred to as salts (Sverdrup et al. 1942). In nearshore areas subjected to freshwater influx, however, salinity is usually slightly lower. In southern California, salinity of nearshore waters is generally between 33 and 34 ppt (Dailey et al. 1993). Reductions in nearshore salinity usually result from freshwater input, while slight increases are often associated with upwelling of colder, more saline bottom waters.

During winter and summer, salinity profiles were near vertical at all stations during both tides. Distinct sub-surface maxima at several stations during winter and summer could be the result of localized upwelling or internal waves. All values were typical of the nearshore waters of southern California, and did not appear to be influenced by the operation of the generating station.

SEDIMENT MONITORING

Sediment Grain Size

In 2001, sediments were coarsest at Station B2, directly upcoast from the generating station discharge, and finest at the discharge. The amount of fine material (silt and clay combined) in sediments ranged from 5.5% at Station B6, inshore of the discharge, to 17.4% at the discharge. Average mean grain size in the study area in 2001 (123 μm) was similar to that recorded in 2000 (120 μm) and to the long-term mean in the study area (Figure 15, Appendix D-1) (MBC 1979, 1981, 1986, 1988, 1990-1994, 1997-2000a; Ogden 1991-1993).

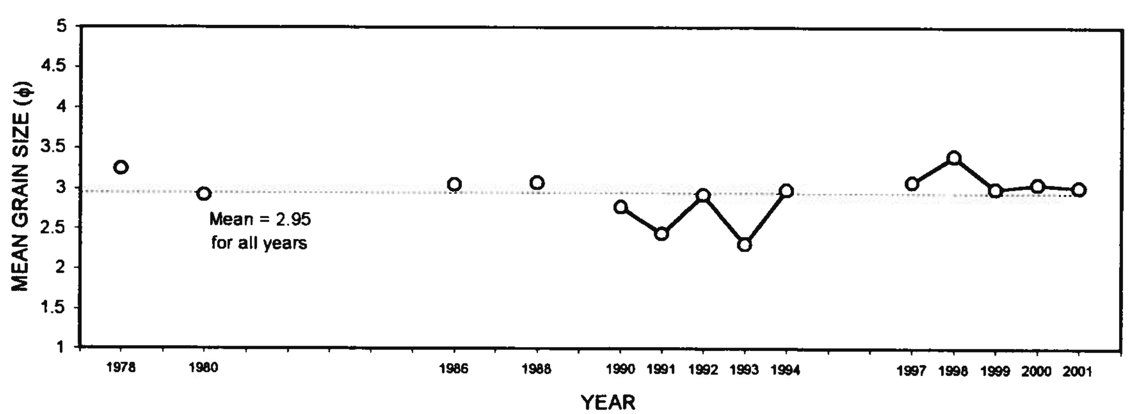


Figure 15. Comparison of sediment mean grain size. Reliant Energy Ormond Beach generating station NPDES, 2001.

In the nine surveys since 1990 (excluding 1998 when only three stations were sampled), sediments were finest at the discharge twice and upcoast of the discharge five times. Coarsest sediments have been collected at the discharge four times and upcoast of the discharge only two times. Coarser sediments at the discharge have been attributed to turbulence associated with the cooling water discharge, which prevents finer sediments from settling. However, in 2001, finest sediments were collected at the discharge, indicating discharge-related turbulence was not affecting grain size distribution in the study area. Instead, sediment characteristics off the generating station this year were likely primarily affected by natural causes, such as nearshore currents, sediment transport, increased wave action from storms, and deposition from rivers. In the east Santa Barbara Channel, the majority of the fine loads originates from the Santa Ynez, Ventura, and Santa Clara rivers (Gorsline et al. 1971). Dredge and sand bypass operations were conducted at the Channel Islands Harbor sand trap and at Hueneme Beach in 1999 and 2000, and are expected to continue in the near future (Smith 2002, pers. comm.). Operations such as these likely contribute to the interannual variation in sediment characteristics in the study area. Results from the 2001 survey indicate no apparent patterns in sediment grain size relative to the discharge of the Ormond Beach generating station.

Sediment Chemistry

Sediment metal concentrations in 2001 were similar among stations and to values recorded in previous surveys (Figure 16, Appendix E-1) (MBC 1990, 1994-2000a; Ogden 1991-1993). Lowest concentrations of all metals were recorded at the discharge and inshore of the discharge. Highest concentrations of all metals occurred at stations upcoast from the discharge. Except for chromium and nickel concentrations at Stations B1, B2, B4, and B5, sediment metal concentrations decreased between 2000 and 2001. Copper concentration reported at the discharge in 2001 (3.5 mg/kg) was much lower than 2000 (20 mg/kg) and well below the long-term mean at that station (6.5 mg/kg).

Differences in metal concentrations among sites are often directly related to the amount of fine-grained material in the sediment. Fine-grained sediments may contain higher amounts of metals due to the greater available surface area (Ackermann 1980, de Groot et al. 1982). Comparisons should take into account the relative amounts of fine and coarse sediments. Sediments in the study area have consistently been sandy. However, highest metal concentrations off Ormond Beach are not always recorded at stations with the finest sediments, including the last three years (Appendix E-1). In 2001, three of the four metals were detected at highest levels at Station B5; however, the percentage of fine material at Station B5 (9.4% by weight) was less than at the discharge (17.4%), Station B1 (13.6%), or Station B4 (11.4%).

In 1991, concentrations of all metals in the study area were elevated above 1990 levels (Figure 16). In 1992, however, concentrations of most metals decreased substantially, and by 1993 metal concentrations were similar to levels detected in 1990. (A similar pattern was recorded in sediment metal concentrations offshore Reliant Energy Mandalay generating station, located upcoast from Channel Islands Harbor [MBC 2000b]). Since 1993, metal concentrations in the study area have been relatively consistent with the exception of the high copper concentration detected in 2000 at the discharge. In 2000, highest levels of chromium, copper, and zinc were detected at the discharge, even though the amount of fine material there was low, suggesting the generating station as a possible source. In 2001 metal concentrations were relatively similar among stations with concentrations of metals slightly higher downcoast of the discharge.

Elevated sediment metal levels may be toxic to some organisms. Ranges of toxicity were developed by the National Oceanographic and Atmospheric Administration (NOAA) (NOAA 1991a) and later updated (Long et al. 1995) using data from spiked sediment bioassays, sediment-water equilibrium partitioning, and the co-occurrence of adversely affected fauna and contaminant levels in the field. Chemical concentrations believed to be associated with adverse biological effects from the various independent studies were compared for each parameter and the lower 10 percentile was designated as the "Effects Range-Low" (ERL). The ERL represents the estimated concentration in which effects would rarely be observed. The median of concentration levels was designated the "Effects Range-Median" (ERM). Concentrations equal to and above the ERL, but below the ERM represent a possible effects range within which effects would occasionally occur (Long et al. 1995). The ERL values are 81 mg/kg for chromium, 34 mg/kg for copper, 20.9 mg/kg for nickel, and 150 mg/kg for zinc. In 2001, metal concentrations were 2.2 to 9.7 times lower than the respective ERL values (Figure 16).

Pollutants come from a variety of sources of both industrial and domestic origin. Oil and gasoline combustion releases many substances, including cadmium, copper, chromium, lead, mercury, and zinc. These and other metals are used in paints, pigments, batteries, manufacturing, and protective coatings. Aerial fallout is a diffuse and potentially large source of contaminants derived from other sources, and may include metals, chlorinated hydrocarbons, and PAHs (SCCWRP 1973, 1986). As these contaminants accumulate on the ground, they are washed into

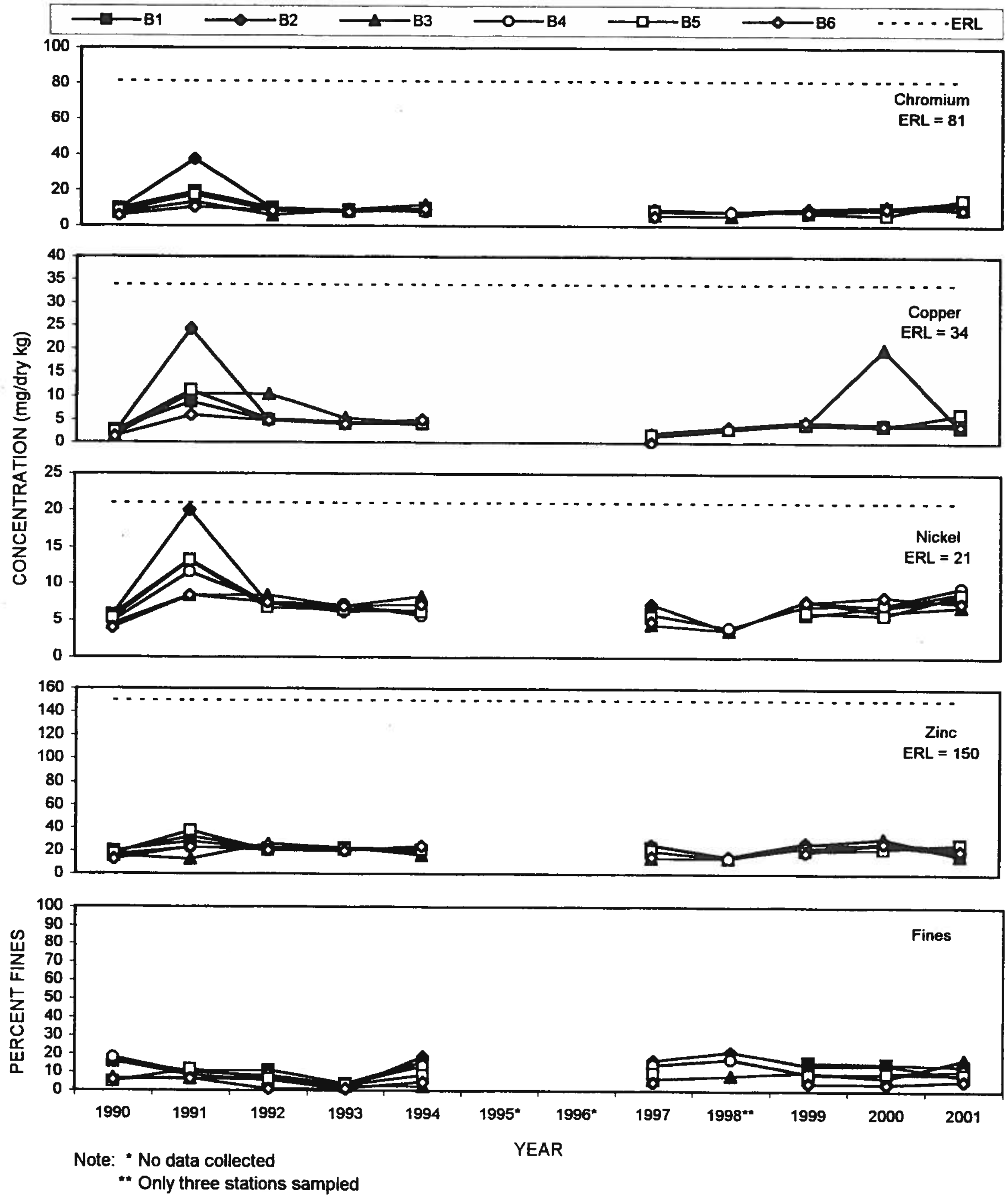


Figure 16. Comparison of sediment metal concentrations and percent fines by station, 1990 - 1994 and 1997 - 2001. Reliant Energy Ormond Beach generating station NPDES, 2001.

rivers and harbors by rainfall, and are eventually deposited in the ocean. Increased regulation has decreased the inputs of some contaminants, which is reflected in decreased levels in the environment.

Sediment metal concentrations have remained relatively consistent in the area since 1990. Metal levels in the area typically vary slightly from year to year. In 2001, metal concentrations were well below levels determined to be potentially toxic to benthic organisms, and within the range of values noted in previous surveys in the study area. There was no spatial pattern that would suggest the Ormond Beach generating station influenced sediment metal levels in the study area in 2001.

MUSSEL BIOACCUMULATION

In 2001, bay mussels from the Ormond Beach generating station discharge area contained detectable amounts of copper and zinc. Chromium and nickel were not detected in mussel tissues in 2001. Chromium has not been detected in mussel tissue from the area since 1991, when chromium was found at a survey high of 65 mg/dry kg (Appendix F, MBC 1990). Nickel was detected in mussel tissue only in 1991 (MBC 1990, 1999-2000a; Ogden 1991-1993). Levels of copper and zinc in mussels were within the range of values detected previously in mussel tissue from the Ormond Beach generating station discharge. Copper concentrations were slightly higher than those detected in 1990, 1992, and 1993, but were lower than those in 1999 and 2000, and much lower than concentrations recorded in 1991 (Figure 17). Zinc levels in 2001 were higher than the levels in 2000, but slightly less than the survey high detected in 1999; they were much higher than levels found from 1990 to 1993.

The California State Mussel Watch program (CSMW) monitors levels of metals and organic pollutants in both bay mussels and California mussels (*Mytilus californianus*). Bioaccumulation of pollutants by the two species was found to be comparable, although some differences were found between the mussels, likely related to habitat preference. Because California mussels have not been found at the Ormond Beach discharge, copper concentrations in bay mussels at Ormond Beach were compared to copper concentrations found by CSMW and NOAA in California mussels in the Southern California Bight from 1980 to 1986. Bight-wide, concentrations of copper in mussel tissue were found to range from 4 to 120 mg/kg (NOAA 1991b). Copper level in mussels collected at the Ormond Beach discharge since 1990 have contained copper at concentrations of about 2 to 56 mg/dry kg, while the maximum replicate concentration in 2001 was 8.7 mg/dry kg (Table 5). These results suggest the operation of the generating station is not elevating copper concentration in local mussel tissues above normal levels. Reference collections from other areas in 2001 suggest that copper is a common contaminant in the bight with replicate levels ranging from 5.3 mg/dry kg at Manhattan Beach Pier to 16 mg/dry kg at Catalina Island. Levels from the same site at Catalina Island from 1990 had tissue levels of 4.3 mg/dry kg of copper suggesting this metal is increasing in concentration throughout the Southern California Bight (Brown and Caldwell 1991). The effects range low level (ERL = the lowest concentration where an effect could be detected) is 34 mg/dry kg suggesting that the levels at the Ormond Beach generating station in 2001 are not harmful to marine life.

In the same CSMW and NOAA studies, zinc concentrations ranged from 80 to 560 mg/dry kg (NOAA 1991b), while in the 2001 survey, the maximum replicate concentration in Ormond Beach mussels was 150 mg/dry kg (Table 5). Although this level is at the ERL level for zinc, it is not an unusual level for mussels collected in the Southern California Bight as noted in the CSMW and NOAA studies. Mean concentrations of zinc in mussel tissue have remained fairly consistent since 1999 (the year with the highest zinc levels since sampling was initiated in 1990) at levels below the ERL of 150 mg/dry kg for zinc. Zinc levels have decreased since 1999 at the Manhattan Beach Pier reference site, but mussel tissue zinc levels at the Catalina Island reference site averaged 230 mg/dry kg in 2001 and 262 mg/dry kg in 1990 (Brown and Caldwell 1991). These values indicate the variability of zinc levels throughout the Southern California Bight and suggest that the operation of the generating station is not elevating zinc concentrations in local mussel tissues.

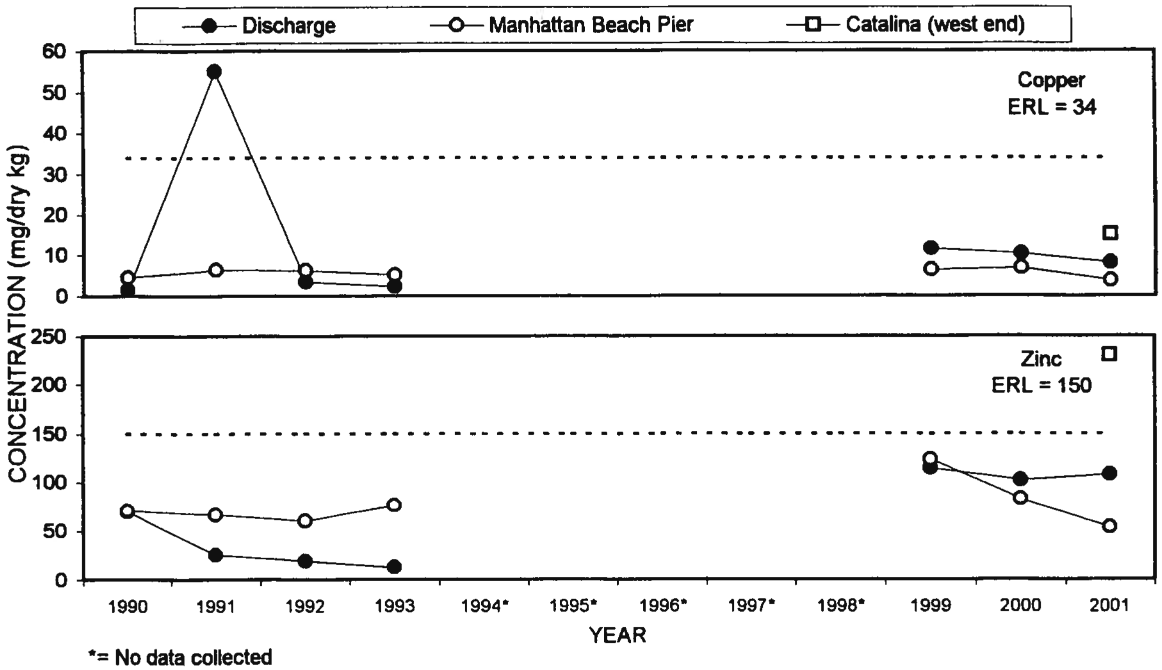


Figure 17. Comparison of copper and zinc concentrations in bay mussel tissue, 1990 - 1993 and 1999 - 2001. Reliant Energy Ormond Beach generating station NPDES, 2001.

BIOLOGICAL MONITORING

Benthic Infauna

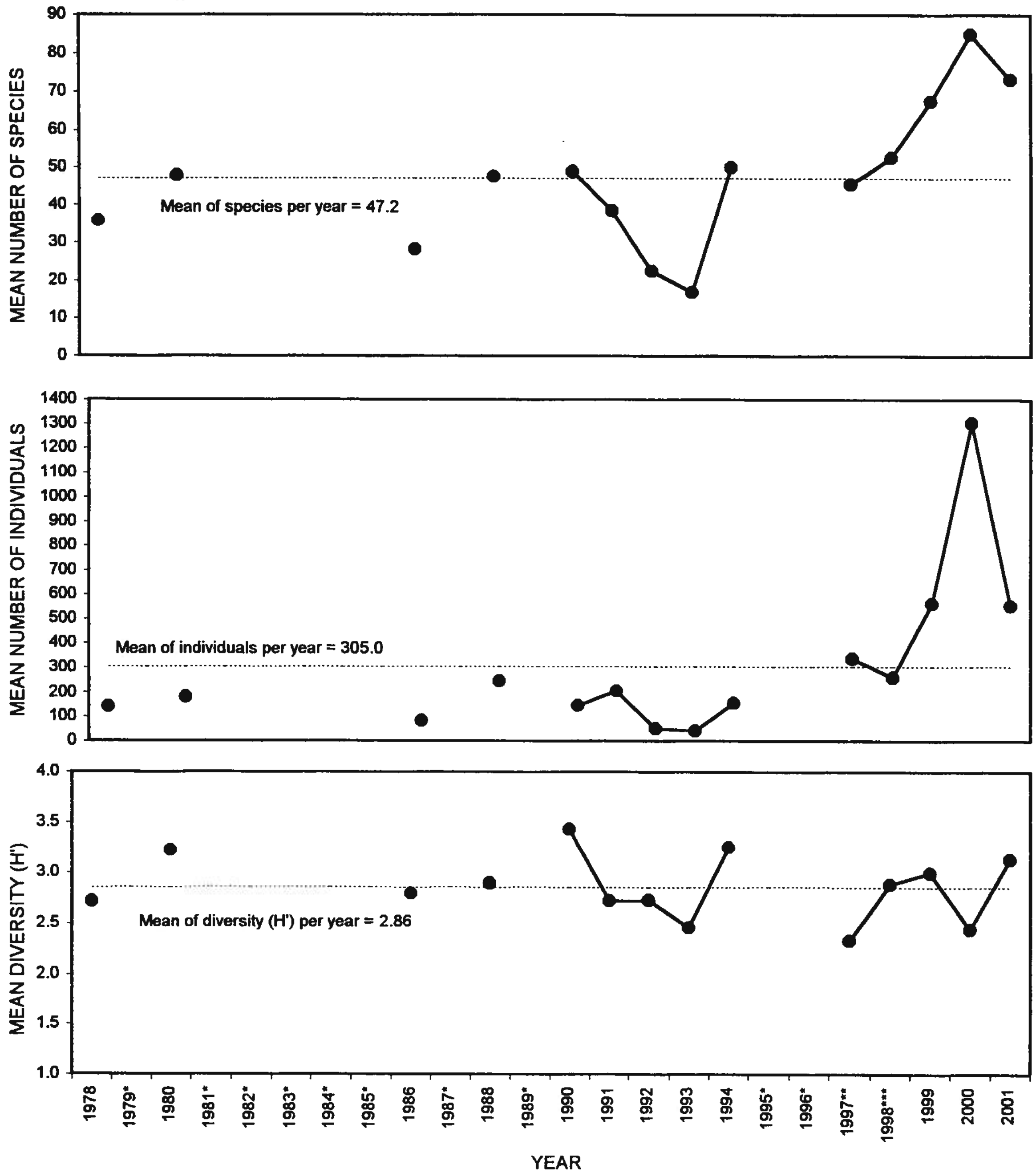
The infauna community in the study area was composed predominantly of small annelid worms, small sand dollars, arthropods, and mollusks. The annelids *Apoprionospio pygmaea*, *Armandia brevis*, and *Owenia collaris*, Pacific sand dollar, the cumacean *Diastylopsis tenuis*, and a clam, *Tellina modesta*, were the most abundant species. Most of the numerically dominant species occurred in similar abundances at the five stations along the discharge isobath, and total abundance was similar among the five stations. The three most abundant species were much more numerous inshore of the discharge than elsewhere; total abundance inshore was more than twice that at any of the stations along the discharge isobath. Despite this high abundance, the number of species was lower than at any other station. Because of the low species richness and the strong numerical dominance of this community by only three species, the species diversity value was particularly low. However, other constituents of the community occurred in similar abundances to those at the other five stations. Species richness for the study area averaged 73 species per station, with an average of 551 individuals per station, or 13,800 individuals/m^2.

Composition of the infauna community reflects the substrate in which it lives (Gray 1974). Particle size and sorting affect sediment stability and cohesiveness, influencing burrowing. The coastline at the Ormond Beach generating station is exposed to swell from both the south and west, and the nearshore subtidal sediments are strongly affected by both storms and normal wave activity. Sediments are generally coarse, due to the winnowing effect of moving water, and there is little organic matter. Generally, nearshore sand faunas tend to be impoverished when compared to offshore siltier sands (Barnard 1963). Species occupying this habitat are adapted to both coarse sediments and to nearly constant disruption of the substrate (Oliver et al. 1980). Although small, these species are capable of reburying themselves quickly after the upper layers of sediment in which they live are disturbed by a passing wave or swell, or they tend to burrow deeper into the sediment and are therefore less affected by disturbance. Many of these species' life history strategies, including frequent and abundant production of young, also allow them to rapidly repopulate habitat severely disrupted during winter storms. The presence of finer sediments indicates a more stable environment, in which deposit-feeding species, such as annelids, can live in permanent tubes (Barnard 1963, Oliver et al. 1980).

The efficient burrowers occurring in the infauna community include the cumacean *Diastylopsis tenuis*, the amphipods *Rhepoxynius abronius*, *R. menziesi* and *Gibberosus myersi*, the plain tellin, *Tellina modesta*, the dish surfclam *Mactromeris catilliformis* and the nemertean worm *Carinoma mutabilis*. These species were generally least abundant inshore, even though sediments there were better sorted than elsewhere. As a group, they did not appear to show a preference among the stations along the isobath, with some of these species more abundant at the discharge and others more abundant upcoast or downcoast. Tube-dwelling species, which typically occur in stable sediments, also did not appear to show preference for any of the stations. *Apoprionospio pygmaea* was far more abundant inshore than anywhere else, but other tube-dwellers such as *Owenia collaris* and the amphipod *Aoroides inermis* were most abundant at or upcoast of the discharge. The burrowing annelid *Armandia brevis*, however, was most abundant inshore, and was also abundant at the discharge and farthest upcoast, where the sediments, although finer than average, contained considerable amounts of mollusk shell fragments. These fragments provided hard substrate for Pacific barnacles (*Balanus pacificus*) and other sessile species. The high species richness encountered at the discharge was most likely due to the combination of fine sediments and shell fragments occurring there. Similar sediments occurred farthest upcoast, where species richness was also high. The abundance of Pacific sand dollars undoubtedly was the result of recent recruitment, as all of the individuals taken in 2001 were small. They were most abundant inshore of the discharge, but were also abundant at and downcoast of the discharge. Studies have suggested that sediment grain size does not influence site selection by larval sand dollars (Timko 1975, Smith 1981).

The infauna community in 2001 was similar to that found in previous surveys conducted in the study area since 1978 (MBC 1979, 1981, 1986, 1988, 1990, 1994, 1997-2000a; Ogden 1991-1993). Average abundance was greater than for all survey years except 1999 and 2000 (Figure 18; abundance value for 1997 excludes nematodes). The high value in 2000 was due to the extremely high abundance of *Owenia collaris*, which comprised almost 42% of the infauna collection. The number of species collected in 2001 was high also, exceeded only by the number in 2000. Because of this high species richness, average species diversity was greater than the long-term mean for the study area. A trend of increasing abundance and species richness seems apparent, but may be part of the variability in the community. Species diversity has shown no consistent trend, although the average value for 2001 was greater than the long-term mean.

Since 1978, average abundance at the discharge (even excluding nematodes in 1997) has been greater than at the other stations, with a trend of decreasing abundance with distance from the discharge along the same isobath (MBC 1979, 1981, 1986, 1988, 1990, 1994, 1997-2000a; Ogden 1991-1993). Average abundance inshore of the discharge has been similar to that farthest downcoast. Overall, however, long-term abundance has been similar among the six stations. Average species richness has been greatest just downcoast of the discharge, but with very little difference among the five stations along the discharge isobath. Average species richness inshore of the discharge has been about one-half that for the other station. Long-term species diversity values were similar among the five stations along the discharge isobath, the value for the discharge station being the lowest of these. The average diversity value for the inshore station was lowest overall, because of low species richness. Studies conducted offshore of Ormond Beach prior to the initiation of the NPDES studies found that abundance, species richness and diversity increased with depth, with species richness having the strongest correlation (MBC 1975). In those studies, the infauna community was considered to be more abundant and diverse than those found at similar depths elsewhere in the Southern California Bight.



* = Survey not conducted. ** 8,375 nematodes excluded from abundance. *** = Only three stations sampled.

Figure 18. Comparison of infaunal community parameters. Reliant Energy Ormond Beach generating station NPDES, 2001.

Composition of the infauna community in 2001 was similar to those in prior surveys (MBC 1979, 1981, 1986, 1988, 1990, 1994, 1997-2000a; Ogden 1991-1993). Most of the very abundant species have been among the long-term dominant species occurring in the study area since 1978, and all of the long-term dominants (averaging 1% or more of all individuals taken) were present in 2001, although not all of them were abundant (Appendix G-5). Some differences from previous surveys were apparent, however. Four of the top 17 species in 2001 were more abundant than in any previous survey, including the most abundant species, *Apoprionospio pygmaea,* and the third most abundant, *Armandia brevis*. Another of these four, *Mactromeris catilliformis*, was taken for the first time in 2001, probably due to a recruitment in the area. This species was also taken for the first time in 2001nearby at Mandalay Beach (MBC 2001a). Species which were less abundant than in the past were those which have exhibited temporal variation. Overall, however, the same core group of species has persisted, and resembles the dominant communities found throughout the Southern California Bight (Barnard 1963, Dexter 1978, Oliver et al. 1980).

Abundance, diversity, and composition of the infauna community in 2001 were most likely to be influenced primarily by sediment characteristics. Species richness was greatest at the discharge and decreased with distance, but the differences among stations were small. This undoubtedly related to the variety of habitats, enhanced by the occurrence of shell fragments, which were present in the sediments at the discharge. Abundance was greatest inshore of the discharge, due to high abundances of three species. Overall, the community was similar to those found in the study area since 1978.

Impingement

Nine heat treatment and 12 normal operation impingement surveys were conducted during the 2001 sample year. In these surveys, at least 47 species of fish and an estimated 15,583 individuals weighing over 2,687 kg were taken. Also taken were at least 19 species of macroinvertebrates, representing an estimated 11,225 individuals weighing over 261 kg.

The 10 most abundant fish species in 2001 accounted for over 83% of the individuals. Six of the 10 most abundant species in 2001 were among the 10 most abundant for the last 12 years (Table 13, Appendix H-13).

Table 13. The 10 most abundant fish species impinged during heat treatment and normal operations, 1990 - 2001. Reliant Energy Ormond Beach generating station NPDES, 2001.

	Year													Percent
Species	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total	Total
queenfish	7460	43501	16697	82521	16382	24008	4218	4725	6632	161	361	1596	208262	62.3
Pacific sardine	322	86	110	1643	362	1056	197	2921	21434	24	89	101	28345	8.5
shiner perch	278	270	997	1333	1023	8830	503	2423	891	8	366	945	17866	5.3
northern anchovy	301	365	891	631	2022	1600	2169	4329	73	177	564	1144	14267	4.3
walleye surfperch	1506	1521	3942	550	126	616	10	1353	431	-	2	611	10667	3.2
white seaperch	1606	987	1054	1019	1169	2454	395	926	158	-	35	218	10022	3.0
plainfin midshipman	1844	1484	999	490	336	432	11	-	-	46	58	1	5700	1.7
white croaker	14	707	149	2506	58	679	50	4	433	-	-	739	5339	1.6
topsmelt	9	105	30	49	-	44	310	1620	204	-	-	1863	4234	1.3
barred surfperch	-	4	-	2	-	-	-	-	190	-	29	3330	3555	1.1
Survey totals														
No. of individuals	14681	51862	28800	94604	23399	41997	8665	19266	31545	763	3078	15583	334243	
No. of species	54	65	54	60	59	48	41	38	47	28	42	47	99	

The most abundant species was Pacific pompano with 21.5% of all individuals; they were ninth in abundance in the long-term record. Pacific pompano are a mid-water schooling species, common from central California southward to central Baja California, Mexico, from 8 to 600 ft depths (Love 1996). They are taken in both the sport and commercial fishery. They are prey for a variety of other commercial fish species, such as kelp bass (*Paralabrax clathratus*), California halibut (*Paralichthys californicus*), and barracuda (*Sphyraena argentea*). Their increase in abundance this year is likely a result of favorable oceanographic conditions, allowing the population to expand.

Queenfish was the second most abundant species in 2001; it was first in overall abundance for the last 12 years. It has been the most abundant species for eight of the last 12 years, varying in abundance during those years from eight to twenty times as many individuals as the next most abundant species (Table 13, Appendix H-13). The number of queenfish impinged in 2001 was less than 20% of the mean for the last 12 years (Appendix H-13). It has been surmised that a long-term decline in the abundance of zooplankton combined with increasing ocean temperatures in the Southern California Bight may be possible factors in this decline (Allen and Moore 1996). These small croakers are common over soft, sandy substrates such as occur offshore of Ormond Beach generating station. They are nocturnal and school near the bottom during the day, but separate and feed in the water column at night (DeMartini et al. 1985). They are relatively weak swimmers, and are easily entrained when they encounter the current field near the intake structure. Queenfish are a major portion of both nearshore trawl and impingement catches in the Southern California Bight (MBC 2000b,c,d,e).

Speckled sanddab was third most abundant species in 2001; speckled sanddab was not taken from 1996 to 1999, and was eleventh in the long-term record (Appendix H-13). Speckled sanddab are a small flatfish with a estimated life span of 3.5 years (Love 1996). They range out to deep water but are most common in shallow water. Because of their small mouth size they eat small prey items, mostly crab, shrimps, and worms. They are not part of the commercial fishery, but are commonly caught by sport fisherman (Love 1996). Their short lifespan probably makes their population susceptible to recruitment failures, which are typical of the recent El Niño, and reflected in the low abundance seen in 1999. Speckled sanddab are among the most common flatfish caught in nearshore trawls (MBC 2000b,c,d).

Northern anchovy was the fourth most abundant species in 2001, as well as fourth in overall abundance for the last 12 years. Northern anchovy is a schooling species which maintains tight schools during the day, feeding in the water column. It is common in the Southern California Bight and is one of the species most frequently captured in sampling conducted by otter trawls and other trawled gear, indicating that it is rather evenly distributed over the mainland shelf offshore of southern California. Northern anchovy is also an important component of the ecosystem in southern California. Anchovy eggs and larvae are prey for vertebrate and invertebrate planktivores (Leet et al. 1992). Juveniles in nearshore areas support a variety of predators, including birds and some recreational and commercially-important species of fish. Adults offshore are utilized by marine fishes, mammals, and birds. A correlation between breeding success of the endangered California brown pelican and anchovy abundance has been observed. Northern anchovy are also important commercially, for use in conversion to meal, oil, and protein products, and as live bait. Its presence in the impingement sampling is due to chance encounters with the intake structure.

In the past several years, some of the common, recurring members of the community offshore of Ormond Beach generating station were absent or occurred in low abundance. White croaker (*Genyonemus lineatus*), Pacific mackerel (*Scomber japonicus*), and topsmelt were not taken in 1999 or 2000, and walleye surfperch, and white seaperch (*Phanerodon furcatus*) were seen in much reduced numbers. In 2001, walleye surfperch, topsmelt, and white croaker have seen a resurgence in abundance, while white seaperch and Pacific mackerel abundances remain low. These species are common schooling species that may encounter the intake during their daily feeding movements along shore. Some, such as the Pacific mackerel are heavily fished by commercial and sport fisheries, with catches in hundreds of tons (Leet et al. 1992). It is likely that abundances of these species were affected by the strong El Niño that began in 1996 and continued through 1998, and the subsequent La Niña. These large scale oceanographic perturbations are known to shift abundances of species to the north or south depending upon the preferred water temperatures of the species, favoring one species recruitment and causing still others to have disastrous recruitment episodes. Still other changes noted are undoubtedly due to the natural variation in year-to-year catches such as the very large catch of Pacific sardine (*Sardinops sagax*) in 1998, while others may be related to reductions or increases in intake flow patterns at the generating station due to variability in electrical demand. In either case, the generating station is unlikely to be the cause of this decline, as these species continue to be abundant at other locales in southern California (MBC 2001b,c). The increases in abundance and the number of species from

1999 indicates that the offshore populations are beginning to return to the conditions seen prior to these widespread environmental disturbances.

The composition of the fish catch during heat treatments differed from the normal operations catch, with some species relatively more abundant during heat treatments. Most of the species found to be more abundant at heat treatments are schooling species which are generally more tolerant of conditions in the forebay. They aggregate in lower velocity flow areas, where they survive until the next heat treatment. The other species are bottom dwellers or slow and clumsy swimmers, which are less able to cope with the currents and turbulence in the forebay of the generating station and, therefore, are impinged on a daily basis during normal operation screen cleaning activities.

Biomass of fish impinged during normal operations was about ten times higher than the biomass from heat treatments. This is similar to the long term average from 1979 to 2001, which was six-fold greater than the average heat treatment biomass (Table 14). The trend in recent years has been a substantial drop in normal operation biomass and variability in heat treatment biomass. Since 1988, biomass collected during normal operations has been slightly more than one-tenth of the 23 year average. This reduction is most likely due in part to the decline in electrical demand at the station but could also be related to zooplankton decreases in the Bight. The generating station has operated at only 8% to 36% of its rated capacity since 1987, when it was operating at 52% capacity. In 2001, with an increase in operating capacity, there has been an slight increase in biomass; combined biomass from normal operations and heat treatments has remained similar since 1987, mostly between 1,100 and 2,700 kg per year. Biomass in 2001 was increased by the unusually high number of individuals of three cartilaginous fish species, Pacific electric ray, bat ray, and thornback. Each individual of these three species has more biomass than many individuals of most of the other species present in impingement samples.

Table 14. Fish biomass (kg) collected during heat treatment and normal operations, 1979 - 2001. Reliant Energy Ormond Beach generating station NPDES, 2001.

Year	Daily Operation	Heat Treatment	Total
1979	36741.7	2375.6	39117.3
1980	20437.2	655.9	21093.1
1981	13890.5	2074.5	15965.0
1982	5860.0	2221.8	8081.8
1983	16388.1	571.0	16959.1
1984	6333.4	374.6	6708.0
1985	4018.4	433.2	4451.6
1986	6037.9	1629.0	7666.9
1987	10606.6	769.1	11375.7
1988	1108.0	793.0	1901.0
1989	1163.4	763.8	1927.2
1990	1026.7	322.4	1349.1
1991	1166.4	1543.5	2709.9
1992	346.7	1312.4	1659.1
1993	949.7	1731.1	2680.9
1994	457.5	646.2	1103.7
1995	548.8	931.6	1480.4
1996	395.7	324.9	720.6
1997	561.3	543.7	1105.0
1998	226.2	715.0	941.2
1999	328.1	33.7	361.8
2000	170.1	141.4	311.5
2001	2456.4	231.3	2687.7
Summary			
Total	131218.9	21138.7	152357.6
Mean	5705.2	919.1	6624.2

Length-frequency histograms were constructed for three abundant species to determine if the intake was preferentially entraining certain size classes, and whether average size structure of the population has changed with time. The queenfish population structure was bimodal, showing a cross section of the population ranging from Age-0 to Age-2 (Love 1996). The peak at 70 mm SL represent Age-0 individuals probably spawned during different months prior to being impinged. The peak at 130 mm SL represents Age-1 individuals. A similar peak at 110 mm SL was noted in 1997, and again in 1993 at 100 mm SL, whereas a bimodal population structure was seen in 1994 and 1992, with peaks at 75 and 115 mm SL and 75 and 155 mm SL, respectively (Ogden 1992, 1993; MBC 1994, 1997). The shiner perch population ranged from Age-0 to Age-3, with most of the individuals two-year-old to three-year-old (70 to 100 mm SL) (Love 1996). The population structure had a single mode with a peak at 80 mm, showing a broad cross section of the of the population up to Age-3. Shiner perch were examined in 1997 and 1998; both years showed unimodal populations, with peaks at 60 mm and 70 mm SL, respectively (MBC 1997, 1998). In 2001, the range of the population has remained similar, with the mode shifting slightly from year to year. The barred sand bass population ranged from Age-1 to Age-10, with most of the individuals from three-year-old to six-year-old (170 to 290 mm SL) (Hulbrock 1974). There have been too few individuals in most years to construct a histogram, but in 1990, the population mode was centered about 250 mm SL (MBC 1990), and in 2000 the mode was about 230 mm SL (MBC 2000a). Barred sand bass is heavily fished by the sport fishing industry, and it is unlikely the generating station is having any effects on their population. The range and distribution of size classes, and recurrence of these size classes among these various years indicate non-preferential entrainment, and differences from year to year are likely a result of natural variability.

The most abundant macroinvertebrate taken was Pacific rock crab. It, and other members of the genus *Cancer*, frequently dominate the nearshore rocky environment. Most of the macroinvertebrate species impinged at the station were crabs and shrimp that live in and on the fouling community in the pipes of the intake cooling structure. With a constant strong current flow into the generating station, larvae are entrained, settle, and grow in ideal conditions, and are always present in the system. Abundance during the periodic heat treatments has remained similar from year to year, and it is unlikely there has been any effect on the offshore population by the generating station.

All of these fish and invertebrate species occur throughout the Southern California Bight. The lack of any evidence that the population of any impinged species has been changed due to the operation of the Ormond Beach generating station indicates that the intake has had a negligible effect on the nekton populations offshore.

CONCLUSIONS

Results of NPDES monitoring studies conducted in winter and summer 2001 indicate only localized effects on water quality offshore the Ormond Beach generating station. Slightly warmer surface waters at stations in the vicinity of the discharge in winter and summer were the result of the discharge of warm water from the generating station. Slightly warmer waters at these stations led to slight depressions in dissolved oxygen. In summer, higher dissolved oxygen and pH values during afternoon sampling likely resulted from increased primary production. All water quality parameters were within ranges considered normal for the nearshore waters of southern California.

Sediments in the study area in 2001 consisted mostly of sand, with a mean grain size in the very fine sand category. Sediments were finest at the discharge and coarsest 1,000 ft upcoast of the discharge. Sediments characteristics were similar to those recorded in previous surveys in the study area. There were no spatial patterns apparent to suggest effects from the Ormond Beach generating station on sediment characteristics in the study area.

In 2001, sediment concentrations of most metals were lowest at the generating station discharge. Highest metal concentrations were detected at stations 1,000 ft and 3,000 ft upcoast from the discharge. All sediment metal levels were within the range noted in previous surveys and were well below levels determined to be potentially toxic to benthic organisms. There was no indication in 2001 that the Ormond Beach generating station is affecting sediment metal concentrations in the study area.

Bay mussel tissue collected at the Ormond Beach generating station discharge in 2001 contained detectable concentrations of copper and zinc. Chromium and nickel were not detected in mussel tissues in 2001, and have not been detected in the area since 1991. Levels of copper and zinc in mussels were within the range of values detected previously in mussel tissue from the area, with values in the lower range of those detected from similar surveys in the Southern California Bight. It appears that the operation of the Ormond Beach generating station is not adversely affecting metal levels in the study area.

The infauna community in the study area in 2001 was composed primarily of small annelids, Pacific sand dollars, arthropods, mollusks, and nemertean worms. Community composition was similar among the six stations, with greater numbers of individuals of some species inshore of the discharge where sediments were best sorted. Abundance and species richness were similar among stations along the discharge isobath. Abundance was greatest and species richness and diversity were lowest inshore. Overall, however, the communities were typical of the shallow subtidal habitat throughout the Southern California Bight, and no pattern relating to the discharge was apparent. Abundance, species richness, and diversity were greater than the long-term means, with the second highest number of species recorded since 1978. A trend of increasing abundance and species richness is apparent, but is probably due to natural variability in the infauna community.

Heat treatment and normal operation data in 2001 indicated that there has been a recovery in the core community offshore that was disrupted due to the combined effects of environmental perturbations such as the recent El Niño and La Niña. These effects were manifested by unusually low abundances in 1999 and 2000. The greater diversity and abundance noted in 2001 indicates that these effects are rapidly waning. Indications are that the core group of species remain diverse and healthy offshore of the Ormond Beach generating station and that the intake appears to have a negligible effect on the nekton of the area.

The overall results of the 2000 NPDES monitoring program indicated that operation of the Reliant Energy Ormond Beach generating station had no detectable effects on the beneficial uses of the receiving waters.

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APPENDIX A

Receiving water monitoring specifications

Reliant Energy Incorporated
Ormond Generating Station
Monitoring and Reporting Program No. CI-5619

CA0001198
Order No. 01-092

V. RECEIVING WATER MONITORING

A. Receiving Water

1. Pursuant to the Code of Federal Regulations [40 CFR § 122.41(j) and §122.48(b)], the monitoring program for a discharger receiving a NPDES permit must determine compliance with NPDES permit conditions, and demonstrate that State water quality standards are met.

2. Since compliance monitoring focuses on the effects of point source discharge, it is not designed to assess impacts from other sources of pollution (e.g., nonpoint source runoff, aerial fallout) nor to evaluate the current status of important ecological resources on a regional basis.

B. Regional Database

1. Several efforts are underway to develop and implement a comprehensive regional monitoring program for the Southern California Bight. These efforts

have the support and participation from regulatory agencies, dischargers, and environmental groups. The goal is to establish a regional program to address public health concerns, monitor trends in natural resources and nearshore habitats, and assess regional impacts from all contaminant sources.

2. Two pilot regional monitoring programs were conducted; one during the summer of 1994 and another in 1998. The purpose of the pilot programs were to test an alternative sampling design that combines elements of compliance monitoring with a broader regional assessment approach. The pilot program was designed by USEPA, the State Board, and three regional Boards (Los Angeles, Santa Ana, and San Diego) in conjunction with the Southern California Coastal Water Research Project and participating discharger agencies.

   The pilot regional monitoring programs included the following components: microbiology; water quality; sediment chemistry; sediment toxicity testing; benthic infauna; demersal fish; and bioaccumulation.

3. The two pilot regional monitoring programs were funded primarily by resource exchanges with the participating discharger agencies. During the year when the pilot regional monitoring was scheduled, USEPA and this Regional Board eliminated portions of the routine compliance monitoring programs for that year, while retaining certain critical compliance monitoring elements. A certain percentage of the traditional sampling sites were also retained to maintain continuity of the historical record and to allow comparison of different sampling designs. The exchanged resources were redirected to complete sampling within the regional monitoring program design. Thus, the Discharger's overall level of effort for the 1994 and 1998 pilot programs remained approximately the same as the compliance monitoring programs.

4. Given the apparent benefits realized by the first two regional monitoring programs, it is probable that similar comprehensive sampling efforts will be repeated for the California Bight at periodic intervals (perhaps every four or five years). At the present time, it appears likely that the next regional monitoring program will be attempted during the summer of 2002 - 2003.

5. We anticipate that future regional monitoring programs will be funded in a similar manner. Revisions to the routine compliance monitoring program will be made under the direction of the USEPA and this Regional Board as necessary to accomplish this goal; and may include resource exchanges in the number of parameters to be monitored, the frequency of monitoring, or the number, type, and location of samples collected.

6. The compliance monitoring programs for the Mandalay Generating Station, and other major ocean dischargers will serve as the framework for the regional monitoring program. However, substantial changes to these programs may be required to fulfill the goals of regional monitoring, while retaining the compliance monitoring component required to evaluate the potential impacts from NPDES discharges. Revisions to the existing program will be made under the direction of the USEPA and this Regional Board as necessary to accomplish this goal; and may include a reduction or increase in the number of parameters to be monitored, the frequency of monitoring, or the number, type, and location of samples collected.

C. Receiving Water Monitoring

The receiving water monitoring program shall consist of periodic biological surveys of the area surrounding the discharge, and shall include studies of those physical-chemical characteristics of the receiving water which may be impacted by the discharge.

Location of Sampling Stations (see Attached Figure 1):

1. Receiving water stations in the surf zone shall be located as follows:

   a. Station RW1 – 3000 feet upcoast of the discharge terminus, at a depth of 30 feet.

   b. Station RW2 - 1000 feet upcoast of the discharge terminus, at a depth of 30 feet.

   c. Station RW3 - At the point of discharge.

   d. Station RW4 - 1000 feet downcoast of the discharge terminus, at a depth of 30 feet.

   e. Station RW5 - 3000 feet downcoast of the discharge terminus, at a depth of 30 feet.

   f. Station RW6 – along the centerline of the discharge conduit, at a depth of 20 feet.

   g. Station RW7 – along the centerline of the discharge conduit, at a depth of 40 feet.

h. Station RW8 – 7,920 feet downcoast of the discharge terminus, at a depth of 30 feet.

i. Station RW9 – 7,920 feet upcoast of the discharge terminus, at a depth of 30 feet.

2. Benthic stations shall be located as follows:

   Stations B1 through B6 shall be located directly beneath Stations RW1 through RW6, respectively.

D. Type and Frequency of Sampling:

1. Temperature profiles shall be measured semiannually (summer and winter) each year at Stations RW1 through RW9 from surface to bottom at a minimum of one-meter intervals. Dissolved oxygen levels and pH shall be measured semiannually at least at the surface, mid-depth and bottom at each station. All stations shall be sampled during both a flooding tide and an ebbing tide during each semiannual survey.

2. Impingement sampling for fish and commercially important macroinvertebrates shall be conducted at least once every two months at Intake Serial No. 001. Impingement sampling shall coincide with heat treatments.

   Fish and macroinvertebrates shall be identified to the lowest possible taxon. For each intake point, data reported shall include numerical abundance of each fish and macroinvertebrate species, wet weight of each species (when combined weight of individuals in each species exceeds 0.2 kg), number of individuals in each 1-centimeter size class (based on standard length) for each species and total number of species collected. When large numbers of given species are collected, length/weight data need only be recorded for 50 individuals and total number and total weight may be estimated based on aliquots samples. Total fish impinged per heat treatment or sampling event shall be reported and data shall be expressed per unit volume water entrained.

3. Native California mussels (Mytilus Californianus) shall be collected during the summer from the discharge conduit, as close to the point of discharge as possible, for bioaccumulation monitoring. The mussels shall be collected and analyzed as described in Appendix A of the *California State Mussel Watch Marine Water Quality Monitoring Program 1985-86* (Water Quality Monitoring Report No. 87-2WQ). Mussel tissue shall be analyzed for copper, chromium, nickel, and zinc at a minimum.

6. Benthic sampling shall be conducted annually during the summer at Stations B1 through B6.

   a. One liter sediment core samples shall be collected by divers at each of the benthic stations for biological examination and determination of biomass and diversity, and for sediment analyses. Four replicates shall be obtained at each station for benthic analyses, and each shall be analyzed separately. A fifth sample shall be taken at each station for sediment analyses and general description.

   b. Each benthic replicate sample shall be sieved through a 0.5 mm standard mesh screen. All organisms recovered shall be enumerated an identified to the lowest taxon possible. Infaunal organisms shall be reported as concentrations per liter for each replicate and each station. Total abundance, number of species and Shannon-Weiner diversity indices shall be calculated (using natural logs) for each replicate and each station.

      Biomass shall be determined as the wet weight in grams or milligrams retained on a 0.5 millimeter screen per unit volume (e.g., 1 liter) of sediment. Biomass shall be reported for each major taxonomic group (e.g., polychaetes, crustaceans, mollusks) for each replicate and each station.

   c. Sediment grain size analyses shall be performed on each sediment sample (sufficiently detailed to calculate percent weight in relation to the size). Sub-samples (upper tow centimeters) shall be taken from each sediment sample and analyzed for copper, chromium, nickel and zinc.

7. The following general observations or measurement at receiving water, benthic and trawl stations shall be reported:

   a. Tidal stage, time, and date of monitoring.
   b. General water conditions.
   c. Color of the water.
   d. Appearance of oil films or greases, or floatable materials.
   e. Extent of visible turbidity or color patches.
   f. Direction of tidal flow.
   g. Description of odor, if any, of the receiving water.
   h. Depth at each station for each sampling period.

i. Presence or absence of red tide.
j. Presence and activity of marine life.
k. Presence of the California least tern and California brown pelican.

8. During the discharge of calcareous material (excluding heat treatment discharge) to the receiving waters, the following observations or measurements shall be recorded and reported in the next monitoring report:

a. Date and times of discharge(s).
b. Estimate of volume and weigh of discharge(s).
c. Composition of discharge(s).
d. General water conditions and weather conditions.
e. Appearance and extent of any oil films or grease, floatable material or odors.
f. Appearance and extent of visible turbidity or color patches.
g. Presence of marine life.
h. Presence and activity of the California least tern and the California brown pelican.

SUMMARY OF RECEIVING WATER MONITORING PROGRAM

Constituent	Units	Stations	Type of Sample	Minimum Frequency of Analysis
Temperature	°C	RW1-RW9	vertical profile	semiannually (flood, ebb)
Dissolved oxygen	mg/L	RW1-RW9	vertical profile	semiannually (flood, ebb)
pH	pH Units	RW1-RW9	vertical profile	semiannually (flood, ebb)
Fish and macro Invertebrates	----	Intake No. 001	impinge-ment	bimonthly
Mussels	----	Discharge	tissue	annually
Benthic Infauna	----	B1-B6	grab	annually
Sediments	----	B1-B6	grab	annually

Reliant Energy Incorporated
Ormond Generating Station
Monitoring and Reporting Program No. CI-5619

CA0001198
Order No. 01-092

The receiving water monitoring report containing the results of semiannual and annual monitoring shall be received at the Regional Board by March 1 of each year following the calendar year of data collection.

VI. STORM WATER MONITORING AND REPORTING

The Discharger shall implement the Monitoring and Reporting Requirements for individual discharges contained in the general permit for *Dischargers of Storm Water Associated with Industrial Activities* (State Board Order No. 97-030-DWQ) adopted on April 17, 1997. The monitoring reports shall be received at the Regional Board by July 1 of each year. Indicate in the report the Compliance File CI-5619.

Ordered by: ______________________
Dennis A. Dickinson
Executive Officer

Date: June 28, 2001

/CDO

Appendix A. (Cont.).

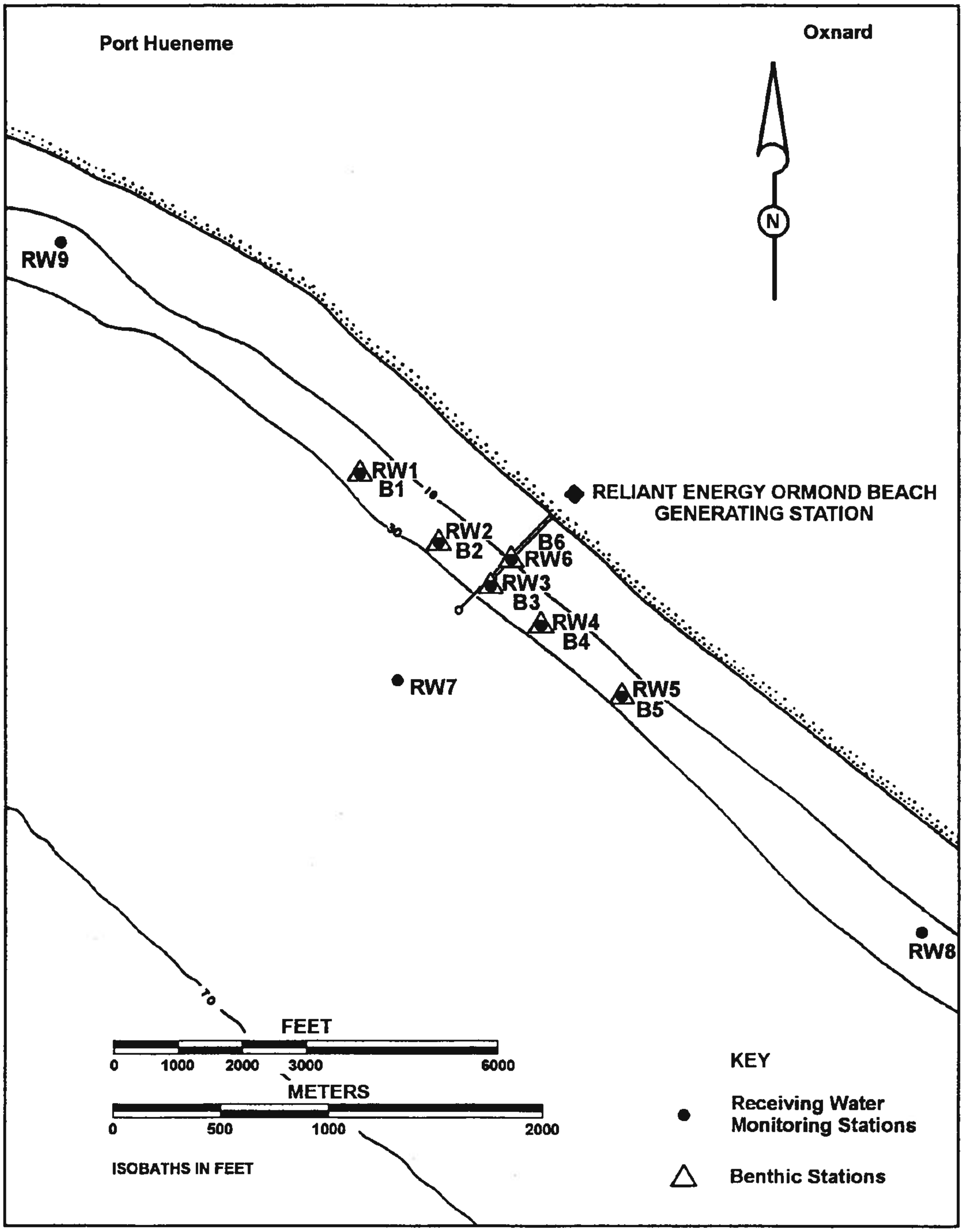


Figure 1. Locations of the sampling stations. Reliant Energy Ormond Beach Generating Station.

APPENDIX B

Grain size techniques

Appendix B. Grain size techniques.

Sediment Grain Size Analysis

Analysis of sediment samples for size distribution characteristics are performed using two techniques. Sediments in the gravel size range (> 2.0 mm in diameter) are analyzed using a series of standard sieves having screen openings of 0.5 phi increments (diameter in phi units = $-\log_2$ diameter in mm, or = -ln diameter in mm ÷ ln 2). The sand-silt-clay fraction of sediments [-1 phi through 4 phi (2.0 mm through 0.0625 mm) for sand], [4 phi through 8 phi (0.0625 mm through 0.004 mm) for silt, 8 phi and greater for clay (0.0039 mm and smaller)] is analyzed by laser light diffraction. The sample is suspended in a suspension column and continuously circulated through the laser beam. The laser beam passes through the sample where the suspended particles scatter incident light. Fourier optics collect diffracted light and focus it on to three sets of detectors. A composite, time-averaged diffraction pattern is measured by 126 detectors. Sizes are computed and summed into normal distribution classifications.

Laboratory data from the two methods are mathematically combined and entered into a computer program which calculates and prints size-distribution characteristics and plots both interval and cumulative frequency distribution curves.

Analysis of the plotted cumulative size frequency curves is performed as described by Inman (1952). The median, 5th, 16th, 84th, and 95th percentiles (converted to phi notation) of the sediment distribution curve is used to calculate mean grain size diameter, sorting coefficient, and measures of skewness and kurtosis. Where sediment distribution coincides with a normal distribution curve, the 16th and 84th percentiles represent diameters one standard deviation on either side of the mean. The following formulas are used in the calculations:

1. Mean Diameter (M_ϕ) is the average particle size in the central 68% of the distribution.

$$M_\phi = \left(\phi_{16} + \phi_{50} + \phi_{84}\right) / 3$$

2. Sorting (σ_ϕ) measures the uniformity (or non-uniformity) of particle quantities in each size category of the sediment distribution. A σ_ϕ value under 0.35ϕ indicates that particles are very well sorted (i.e. sediments are primarily composed of a narrow range of size classes, or a single size class), while a value of over 4.0ϕ indicates that the sediments are extremely poorly sorted, or evenly distributed among size classes.

$$\sigma_\phi = \frac{\phi_{84} - \phi_{16}}{4} + \frac{\phi_{95} - \phi_5}{6.6}$$

3. Skewness (α_ϕ) is a measure of the direction and extent of departure of the mean from the median (in a normal or symmetrical curve they coincide). In symmetrical curves, α_ϕ=0.00 with limits of -1.00 and +1.00. Negative values indicate the particle distribution is skewed toward larger particle diameters, while positive values indicate the distribution is skewed toward smaller particle diameters.

$$\alpha_\phi = \frac{\phi_{16} + \phi_{84} - 2\phi_{50}}{2\left(\phi_{84} - \phi_{16}\right)} + \frac{\phi_5 + \phi_{95} - 2\phi_{50}}{2\left(\phi_{95} - \phi_5\right)}$$

4. Kurtosis (β_ϕ) is a measure of how far the sediment distribution curve departs from a normal Gaussian shape at its peak. Curves with greater than normal amounts of sediment at their modes will be sharp or leptokurtic (β_ϕ > 1). Those with fatter tails and lower peaks than expected are termed platykurtic (β_ϕ < 1). β_ϕ = 1.00 for a normal curve. Curve category interpretations are based on Folk (1974).

$$\beta_\phi = \frac{\phi_{95} - \phi_5}{2.44\left(\phi_{75} - \phi_{25}\right)}$$

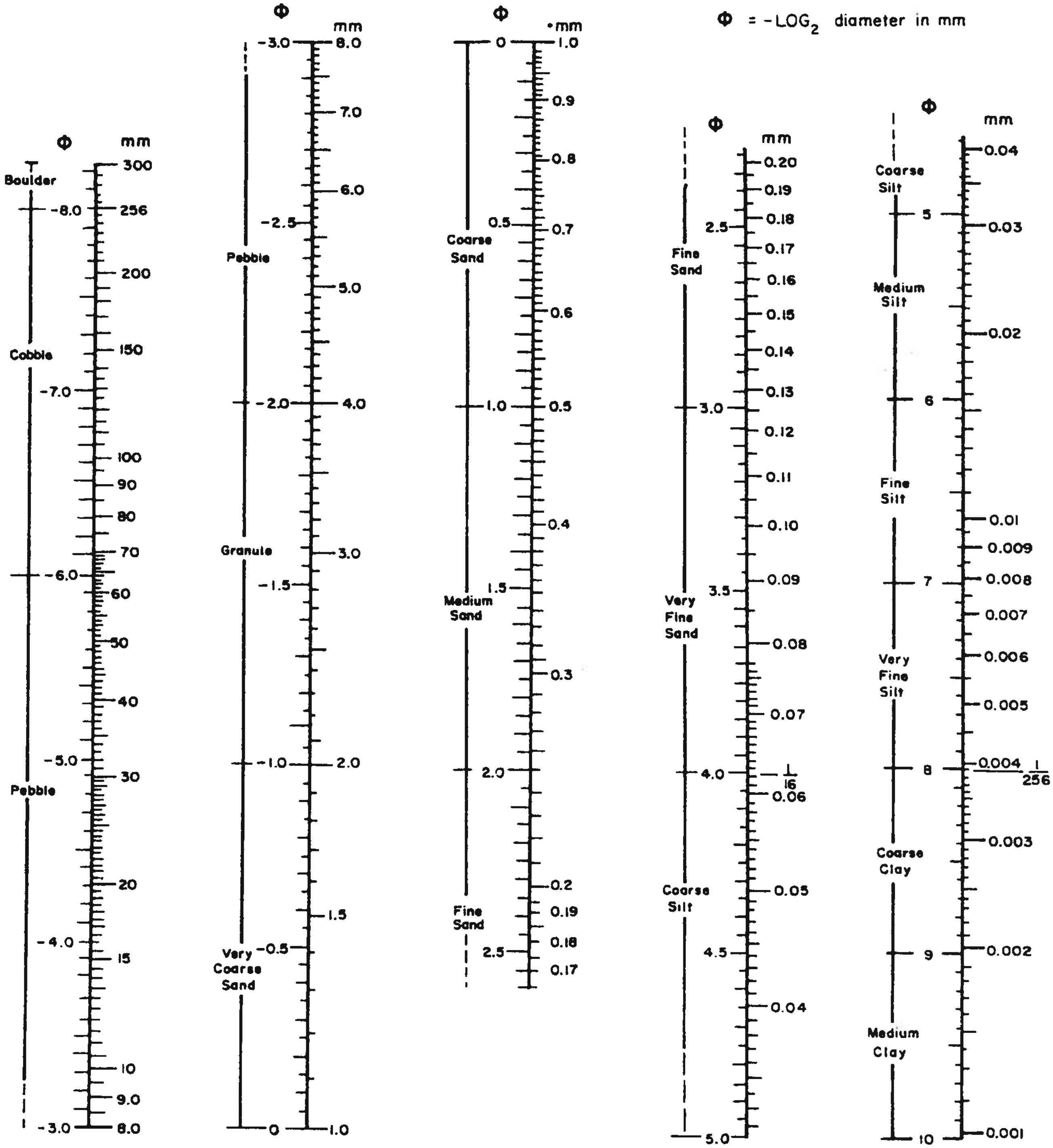
LITERATURE CITED

Folk, R. L. 1974. Petrology of sedimentary rocks. Hemphill Publishing Co., Austin, TX. 182 p.

Inman, D. L. 1952. Measures for describing the size distribution of sediments. J. Sed. Pet. 22:125-145.

Appendix B. (Cont.).

Phi - Millimeter Conversion Figure



Measurement sorting values for a large number of sediments has suggested the following verbal classification scale for sorting:

σ_I under	.35 ϕ,	very well sorted
	.35-.50 ϕ,	well sorted
	.50-.71 ϕ,	moderately well sorted
	.71-1.0 ϕ	moderately sorted
	1.0-2.0 ϕ,	poorly sorted
	2.0-4.0 ϕ,	very poorly sorted
	over 4.0 ϕ,	extremely poorly sorted

APPENDIX C

Water quality parameters at each receiving water monitoring station

Appendix C-1. Water quality parameters at each receiving water monitoring station during flood and ebb tides. Reliant Energy Ormond Beach generating station NPDES, winter 2001.

		Temp. (°C)		Oxygen (mg/l)		pH		Salinity (ppt)	
	Depth (m)	FLOOD	EBB	FLOOD	EBB	FLOOD	EBB	FLOOD	EBB
RW1	0	14.39	14.33	7.94	8.31	7.97	7.99	33.40	33.36
	1	14.35	14.33	7.86	8.32	7.97	7.99	33.40	33.36
	2	14.32	14.33	8.02	8.32	7.97	7.99	33.40	33.36
	3	13.67	14.33	8.15	8.35	7.95	7.99	33.46	33.36
	4	13.26	14.33	8.27	8.32	7.94	7.99	33.47	33.36
	5	13.08	14.33	8.03	8.33	7.92	8.00	33.48	33.36
	6	13.05	14.32	7.68	8.35	7.92	8.01	33.47	33.36
	7	13.04	14.32	7.51	8.34	7.92	8.00	33.47	33.36
	8	12.95	14.29	7.47	8.35	7.91	8.01	33.47	33.36
	9	12.74	14.29	7.34	8.36	7.90	8.00	33.48	33.36
	10	12.68	14.29	7.14	8.32	7.90	8.00	33.48	33.36
	11		14.27		8.34		8.01		33.36
RW2	0	15.64	14.29	7.71	8.30	7.93	8.00	33.41	33.36
	1	15.59	14.30	7.75	8.27	7.93	8.00	33.40	33.35
	2	15.53	14.29	7.77	8.33	7.94	8.00	33.40	33.36
	3	14.40	14.29	8.04	8.35	7.95	8.01	33.57	33.36
	4	13.42	14.29	8.09	8.34	7.95	8.00	33.50	33.36
	5	13.16	14.29	7.86	8.34	7.93	8.01	33.46	33.36
	6	12.85	14.28	7.83	8.34	7.92	8.01	33.49	33.36
	7	12.83	14.28	7.68	8.34	7.91	8.01	33.50	33.36
	8	12.84	14.27	7.37	8.35	7.91	8.01	33.47	33.36
	9	12.85	14.21	7.23	8.37	7.91	8.01	33.46	33.36
	10	12.85	14.19	7.22	8.37	7.92	8.01	33.46	33.36
	11	12.86	14.18	7.21	8.31	7.92	8.01	33.46	33.37
RW3	0	15.81	14.30	7.33	8.32	7.91	8.00	33.42	33.35
	1	15.75	14.31	7.32	8.33	7.92	8.00	33.42	33.35
	2	15.66	14.29	7.37	8.33	7.93	8.01	33.42	33.36
	3	15.04	14.29	7.52	8.33	7.94	8.01	33.37	33.36
	4	13.92	14.29	7.72	8.34	7.97	8.01	33.36	33.36
	5	13.67	14.29	7.83	8.36	7.95	8.01	33.39	33.36
	6	13.09	14.28	8.07	8.39	7.94	8.01	33.47	33.36
	7	13.04	14.28	7.77	8.38	7.92	8.01	33.46	33.36
	8	13.03	14.26	7.42	8.35	7.92	8.01	33.44	33.36
	9	12.92	14.22	7.34	8.40	7.92	8.01	33.46	33.36
	10	12.93	14.19	7.23	8.38	7.92	8.01	33.46	33.36
	11		14.19		8.34		8.01		33.36
RW4	0	15.14	16.44	7.94	8.16	7.97	7.98	33.37	33.35
	1	15.15	16.52	7.92	8.20	7.96	7.98	33.39	33.34
	2	15.11	15.75	7.94	8.35	7.97	7.98	33.38	33.33
	3	14.84	15.02	7.98	8.43	7.97	7.99	33.36	33.28
	4	14.59	14.37	8.06	8.42	7.97	8.00	33.45	33.37
	5	13.44	14.31	8.40	8.46	7.96	8.00	33.40	33.37
	6	13.15	14.30	8.39	8.33	7.94	8.00	33.54	33.37
	7	13.05	14.30	7.92	8.31	7.92	8.01	33.46	33.37
	8	13.06	14.29	7.58	8.30	7.93	8.01	33.46	33.36
	9	13.02	14.29	7.40	8.31	7.92	8.01	33.46	33.36
	10		14.28		8.32		8.01		33.36
RW5	0	14.95	14.72	8.33	8.38	7.99	7.99	33.35	33.24
	1	14.92	14.64	8.36	8.39	8.00	7.99	33.36	33.37
	2	14.90	14.57	8.35	8.41	8.00	8.00	33.36	33.35
	3	14.90	14.58	8.36	8.41	8.00	7.99	33.36	33.36
	4	14.66	14.41	8.43	8.46	7.99	8.01	33.36	33.37
	5	14.23	14.27	8.51	8.46	7.99	7.99	33.39	33.36
	6	13.87	14.24	8.54	8.41	7.97	7.99	33.38	33.36
	7	13.22	14.23	8.52	8.38	7.96	7.99	33.42	33.36
	8	13.15	14.21	8.20	8.39	7.93	8.00	33.45	33.37
	9	13.14	14.21	7.66	8.36	7.93	8.00	33.44	33.36
	10	13.12	14.21	7.55	8.36	7.93	8.01	33.44	33.36
	11	13.14		7.50		7.93		33.43	

Appendix C-1. (Cont.).

		Temp. (°C)		Oxygen (mg/l)		pH		Salinity (ppt)	
	Depth (m)	FLOOD	EBB	FLOOD	EBB	FLOOD	EBB	FLOOD	EBB
RW6	0	14.44	14.32	8.17	8.43	7.95	7.99	33.40	33.35
	1	14.48	14.32	8.13	8.43	7.95	7.99	33.42	33.35
	2	14.74	14.32	8.10	8.39	7.95	7.99	33.37	33.35
	3	14.73	14.32	8.05	8.41	7.95	7.99	33.43	33.35
	4	14.63	14.32	8.07	8.47	7.95	7.99	33.39	33.35
	5	14.43	14.32	8.13	8.44	7.95	8.01	33.42	33.35
	6	14.03	14.32	8.23	8.44	7.95	8.00	33.39	33.35
	7	13.75	14.32	8.31	8.39	7.93	8.01	33.37	33.35
	8	13.38	14.31	7.89	8.41	7.92	8.01	33.35	33.35
	9	13.57	14.29	7.53	8.38	7.91	8.01	33.33	33.35
	10		14.26		8.30		8.00		33.38
RW7	0	14.33	14.32	7.94	8.25	7.95	7.99	33.39	33.37
	1	14.33	14.32	7.91	8.25	7.95	7.99	33.39	33.37
	2	14.33	14.30	7.98	8.26	7.95	7.99	33.39	33.37
	3	14.33	14.30	7.96	8.27	7.97	8.00	33.39	33.37
	4	14.31	14.30	7.97	8.27	7.96	7.99	33.39	33.37
	5	14.23	14.29	7.98	8.28	7.97	7.99	33.39	33.37
	6	14.23	14.28	7.99	8.29	7.97	7.99	33.39	33.37
	7	13.64	14.23	8.14	8.30	7.96	8.00	33.46	33.37
	8	13.30	14.14	8.13	8.31	7.95	7.99	33.49	33.37
	9	13.17	13.99	8.07	8.31	7.94	7.99	33.45	33.37
	10	12.97	13.72	7.94	8.37	7.93	7.97	33.44	33.39
	11	12.66	13.34	7.80	8.35	7.89	7.95	33.50	33.39
	12	12.51	13.18	7.46	7.89	7.88	7.94	33.49	33.42
	13	12.51	13.13	7.12	7.62	7.88	7.93	33.50	33.44
	14		13.13		7.56		7.93		33.44
RW8	0	14.82	14.57	8.23	8.33	7.97	7.99	33.37	33.36
	1	14.79	14.58	8.26	8.32	7.97	7.99	33.38	33.35
	2	14.78	14.56	8.27	8.34	7.98	7.99	33.38	33.36
	3	14.70	14.50	8.29	8.37	7.98	7.99	33.40	33.36
	4	14.40	14.40	8.36	8.36	7.98	7.99	33.38	33.36
	5	13.77	14.35	8.52	8.36	7.95	7.99	33.52	33.36
	6	13.31	14.30	8.31	8.31	7.94	7.99	33.44	33.36
	7	13.15	14.10	7.97	8.31	7.93	7.97	33.45	33.37
	8	13.12	13.58	7.74	8.41	7.93	7.96	33.45	33.48
	9	13.09	13.16	7.59	8.33	7.93	7.94	33.45	33.46
	10	12.73	13.14	7.49	7.75	7.89	7.93	33.48	33.45
	11	12.72	13.16	6.93	7.56	7.88	7.93	33.53	33.45
RW9	0	13.89	14.41	7.71	8.18	7.93	8.01	33.43	33.34
	1	13.88	14.38	7.66	8.30	7.93	8.01	33.43	33.35
	2	13.87	14.38	7.72	8.36	7.93	8.01	33.43	33.35
	3	13.87	14.38	7.73	8.44	7.93	8.01	33.43	33.35
	4	13.87	14.38	7.74	8.42	7.93	8.01	33.43	33.35
	5	13.69	14.36	7.78	8.46	7.93	8.01	33.42	33.35
	6	13.33	14.36	7.85	8.45	7.92	8.01	33.43	33.35
	7	13.22	14.35	7.73	8.45	7.91	8.01	33.45	33.35
	8	12.92	14.33	7.68	8.42	7.92	8.01	33.49	33.35
	9	12.91	14.32	7.59	8.45	7.91	8.01	33.47	33.36
	10	12.74	14.32	7.37	8.42	7.91	8.01	33.49	33.35
	11	12.75	14.31	7.27	8.41	7.90	8.01	33.51	33.35

Appendix C-2. Water quality parameters at each receiving water monitoring station during flood and ebb tides. Reliant Energy Ormond Beach generating station NPDES, summer 2001.

		Temp. (°C)		Oxygen (mg/l)		pH		Salinity (ppt)	
	Depth (m)	FLOOD	EBB	FLOOD	EBB	FLOOD	EBB	FLOOD	EBB
RW1	0	15.00	16.07	7.29	9.12	7.96	8.13	33.50	33.50
	1	14.97	16.06	7.39	9.13	7.96	8.13	33.49	33.51
	2	14.15	16.07	7.67	9.16	7.93	8.13	33.56	33.51
	3	13.65	16.06	7.35	9.15	7.92	8.13	33.54	33.51
	4	13.60	16.01	7.19	9.15	7.91	8.15	33.55	33.51
	5	13.37	15.95	7.21	9.30	7.90	8.16	33.53	33.51
	6	13.11	15.82	7.19	9.58	7.90	8.17	33.54	33.50
	7	12.81	15.66	7.10	9.89	7.89	8.17	33.53	33.52
	8	12.74	15.45	6.93	10.02	7.89	8.13	33.52	33.52
	9	12.76	15.32	6.89	9.54	7.89	8.11	33.53	33.53
	10	12.75	15.27	6.88	9.06	7.89	8.08	33.53	33.51
	11		14.82		8.98		8.05		33.62
RW2	0	15.41	16.28	7.52	10.38	7.99	8.21	33.45	33.50
	1	15.34	16.27	7.73	10.45	7.99	8.21	33.52	33.50
	2	14.49	16.20	7.85	10.52	7.98	8.20	33.76	33.52
	3	13.76	16.05	7.71	10.53	7.96	8.18	33.57	33.52
	4	13.57	15.86	7.34	10.36	7.93	8.17	33.51	33.53
	5	13.30	15.70	7.28	10.19	7.92	8.15	33.50	33.53
	6	12.98	15.64	7.18	9.72	7.89	8.14	33.55	33.51
	7	12.75	15.57	7.07	9.53	7.89	8.13	33.57	33.52
	8	12.68	15.52	6.92	9.38	7.89	8.12	33.54	33.52
	9	12.70	15.49	6.81	9.27	7.89	8.11	33.53	33.51
	10	12.67	15.24	6.82	9.28	7.89	8.10	33.53	33.53
	11		15.00		9.03		7.97		33.54
RW3	0	15.71	19.00	6.55	9.17	7.86	8.14	33.52	33.50
	1	15.57	18.25	6.72	9.37	7.86	8.16	33.53	33.64
	2	15.39	16.45	6.75	9.81	7.87	8.21	33.49	33.73
	3	14.35	16.11	6.94	9.92	7.88	8.19	33.66	33.54
	4	13.23	15.90	7.06	9.88	7.89	8.17	33.82	33.52
	5	12.86	15.68	7.03	9.53	7.89	8.12	33.67	33.54
	6	12.72	15.64	6.94	9.06	7.89	8.12	33.58	33.51
	7	12.65	15.37	6.87	9.01	7.88	8.10	33.55	33.52
	8	12.60	15.20	6.77	8.85	7.87	8.10	33.54	33.55
	9	12.59	15.05	6.74	8.73	7.88	8.07	33.53	33.50
	10	12.60	14.51	6.70	8.55	7.88	7.99	33.53	33.57
RW4	0	16.07	17.77	6.97	8.22	7.90	8.07	33.51	33.46
	1	16.05	17.41	7.01	8.01	7.91	8.08	33.51	33.63
	2	15.96	16.67	7.04	8.31	7.92	8.07	33.52	33.60
	3	15.72	15.82	7.09	8.72	7.93	8.11	33.51	33.65
	4	15.07	15.71	7.22	8.77	7.97	8.11	33.58	33.54
	5	13.69	15.66	7.72	8.90	7.95	8.09	33.67	33.52
	6	12.96	15.63	7.40	8.82	7.92	8.10	33.55	33.51
	7	12.64	15.54	7.10	8.78	7.90	8.09	33.54	33.51
	8	12.61	15.42	6.80	8.73	7.89	8.07	33.54	33.51
	9	12.60	15.28	6.75	8.58	7.89	8.04	33.54	33.55
RW5	0	15.33	17.35	7.76	8.14	8.03	8.10	33.47	33.40
	1	15.48	16.61	7.92	8.70	8.03	8.10	33.48	33.53
	2	14.69	15.82	8.18	8.89	8.01	8.11	33.57	33.62
	3	13.72	15.77	7.93	8.89	7.97	8.11	33.63	33.52
	4	13.40	15.67	7.51	8.96	7.93	8.11	33.60	33.52
	5	13.23	15.54	7.33	8.95	7.92	8.11	33.55	33.52
	6	12.93	15.48	7.23	8.92	7.91	8.10	33.58	33.52
	7	12.64	15.40	7.07	8.90	7.89	8.09	33.56	33.52
	8	12.59	15.29	6.82	8.85	7.89	8.09	33.54	33.51
	9	12.60	14.93	6.73	8.83	7.89	8.05	33.52	33.58
	10		14.71		8.59		8.02		33.52

Appendix C-2. (Cont.).

		Temp. (°C)		Oxygen (mg/l)		pH		Salinity (ppt)	
	Depth (m)	FLOOD	EBB	FLOOD	EBB	FLOOD	EBB	FLOOD	EBB
RW6	0	15.47	18.10	7.01	8.57	7.92	8.06	33.51	33.50
	1	15.46	17.98	7.05	8.59	7.92	8.06	33.52	33.49
	2	15.07	17.01	7.21	8.74	7.92	8.06	33.52	33.64
	3	13.80	16.22	7.46	8.54	7.92	8.05	33.76	33.59
	4	13.29	15.92	7.44	8.16	7.91	8.04	33.56	33.52
	5	13.14	15.56	7.20	8.15	7.90	8.03	33.55	33.55
	6	12.84	15.49	7.12	8.17	7.89	8.01	33.56	33.52
RW7	0	15.18	15.53	7.62	8.13	8.00	8.06	33.49	33.50
	1	15.11	15.53	7.72	8.12	7.99	8.06	33.50	33.51
	2	14.89	15.45	7.76	8.22	7.97	8.05	33.50	33.52
	3	14.48	15.29	7.54	8.28	7.96	8.05	33.47	33.53
	4	14.05	15.17	7.53	8.30	7.95	8.05	33.53	33.52
	5	13.86	15.00	7.50	8.33	7.95	8.05	33.54	33.52
	6	13.76	14.94	7.40	8.38	7.94	8.06	33.53	33.50
	7	13.55	14.88	7.34	8.44	7.94	8.05	33.54	33.50
	8	13.39	14.78	7.23	8.40	7.92	8.04	33.52	33.51
	9	13.09	14.71	7.22	8.31	7.91	8.04	33.50	33.50
	10	12.79	14.63	7.08	8.25	7.90	8.02	33.54	33.51
	11	12.60	14.46	6.89	8.22	7.89	8.02	33.56	33.52
	12	12.49	13.86	6.82	8.22	7.89	7.98	33.57	33.66
	13	12.47	13.40	6.76	7.85	7.89	7.92	33.57	33.53
	14		13.24		7.46		7.90		33.55
RW8	0	14.50	16.39	7.71	9.77	7.98	8.15	33.49	33.49
	1	14.26	16.34	7.79	9.78	7.99	8.15	33.52	33.50
	2	13.85	16.14	7.75	9.86	7.97	8.15	33.56	33.53
	3	13.48	15.78	7.61	9.74	7.95	8.13	33.54	33.53
	4	13.20	15.54	7.40	9.44	7.92	8.12	33.54	33.59
	5	13.05	14.78	7.17	9.47	7.91	8.07	33.52	33.73
	6	12.80	14.66	7.09	8.73	7.90	8.04	33.52	33.53
	7	12.69	14.63	7.00	8.38	7.89	8.04	33.53	33.52
	8	12.67	13.91	6.93	8.43	7.89	7.98	33.52	33.56
	9	12.65	13.01	6.90	8.01	7.89	7.91	33.52	33.69
	10	12.64	12.67	6.88	7.28	7.89	7.88	33.51	33.54
RW9	0	14.38	16.22	7.27	10.36	7.88	8.20	33.50	33.50
	1	14.37	16.20	7.34	10.35	7.88	8.20	33.51	33.51
	2	14.20	16.17	7.41	10.38	7.88	8.20	33.53	33.51
	3	13.93	16.00	7.39	10.42	7.87	8.18	33.56	33.50
	4	13.44	15.88	7.37	10.08	7.87	8.12	33.51	33.51
	5	12.97	15.88	7.25	9.42	7.86	8.11	33.61	33.51
	6	13.09	15.85	7.05	9.29	7.86	8.10	33.54	33.50
	7	12.72	15.77	7.12	9.19	7.85	8.07	33.54	33.50
	8	12.71	15.73	6.96	8.81	7.85	8.06	33.54	33.50
	9	12.72	15.65	6.95	8.60	7.85	8.03	33.53	33.51
	10	12.71	14.69	6.94	8.57	7.86	7.98	33.53	33.54
	11		13.97		8.02		7.96		33.56

APPENDIX D

Sediment grain size distribution and statistical parameters by station

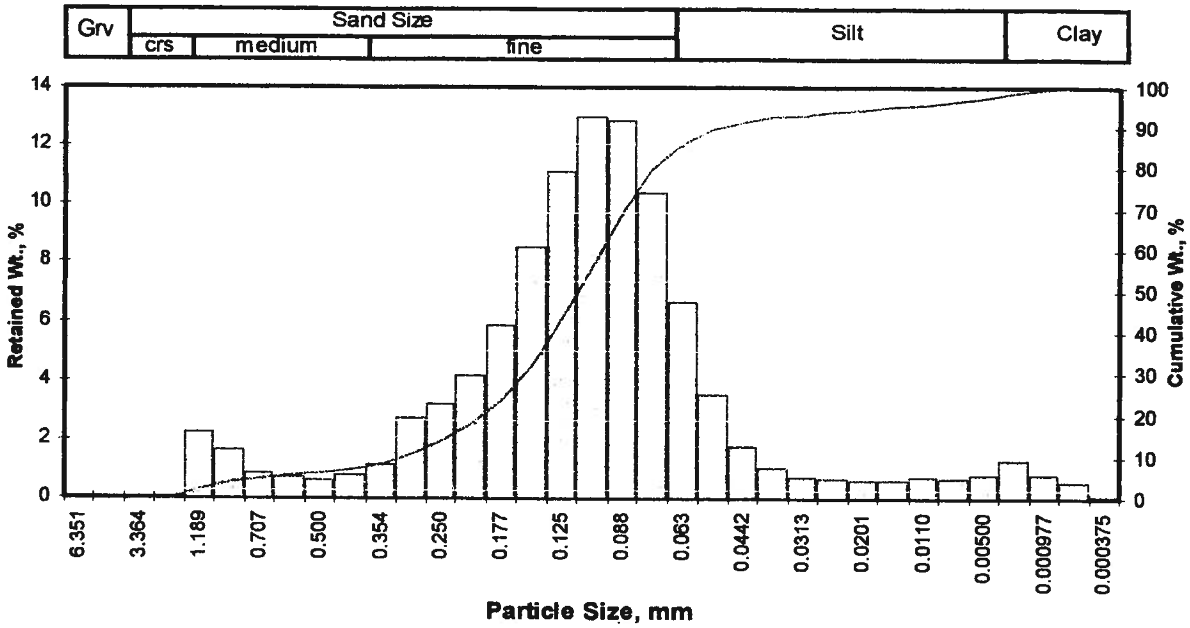
Appendix D. Sediment grain size distribution and statistical parameters by station. Reliant Energy Ormond Beach generating station NPDES, 2001.

Station B1

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Del Mar Analytical	**PTS File No:**	31584
Project:	N/A	**Sample ID:**	IKJ0326-01
Project No:	IKJ0326	**Depth, ft:**	N/A



Opening: Inches	Opening: Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	2.25	2.25	2.25
0.0331	0.841	0.25	20	1.60	1.60	3.85
0.0278	0.707	0.50	25	0.86	0.86	4.71
0.0234	0.595	0.75	30	0.74	0.74	5.46
0.0197	0.500	1.00	35	0.60	0.60	6.06
0.0166	0.420	1.25	40	0.77	0.77	6.83
0.0139	0.354	1.50	45	1.15	1.15	7.98
0.0117	0.297	1.75	50	2.69	2.69	10.67
0.0098	0.250	2.00	60	3.17	3.17	13.84
0.0083	0.210	2.25	70	4.17	4.17	18.01
0.0070	0.177	2.50	80	5.87	5.87	23.88
0.0059	0.149	2.75	100	8.52	8.52	32.40
0.0049	0.125	3.00	120	11.08	11.08	43.48
0.0041	0.105	3.25	140	12.96	12.96	56.44
0.0035	0.088	3.50	170	12.86	12.86	69.30
0.0029	0.074	3.75	200	10.40	10.40	79.70
0.0025	0.063	4.00	230	6.66	6.66	86.36
0.0021	0.053	4.25	270	3.49	3.49	89.85
0.00174	0.0442	4.50	325	1.72	1.72	91.57
0.00146	0.0372	4.75	400	1.02	1.02	92.59
0.00123	0.0313	5.00	450	0.70	0.70	93.28
0.000986	0.0250	5.32	500	0.68	0.68	93.96
0.000790	0.0201	5.64	635	0.59	0.59	94.55
0.000615	0.0156	6.00		0.60	0.60	95.16
0.000435	0.0110	6.50		0.72	0.72	95.88
0.000308	0.00781	7.00		0.66	0.66	96.54
0.000197	0.00500	7.65		0.80	0.80	97.34
0.000077	0.00195	9.00		1.25	1.25	98.59
0.000038	0.000977	10.00		0.80	0.80	99.39
0.000019	0.000488	11.00		0.55	0.55	99.94
0.000015	0.000375	11.38		0.06	0.06	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size: Inches	Particle Size: Millimeters
5	0.60	0.0260	0.662
10	1.69	0.0122	0.310
16	2.13	0.0090	0.229
25	2.53	0.0068	0.173
40	2.92	0.0052	0.132
50	3.13	0.0045	0.115
60	3.32	0.0039	0.100
75	3.64	0.0032	0.080
84	3.91	0.0026	0.066
90	4.27	0.0020	0.052
95	5.91	0.0007	0.017

Measure	Trask	Inman	Folk-Ward
Median, phi	3.13	3.13	3.13
Median, in.	0.0045	0.0045	0.0045
Median, mm	0.115	0.115	0.115
Mean, phi	2.98	3.02	3.06
Mean, in.	0.0050	0.0049	0.0047
Mean, mm	0.127	0.123	0.120
Sorting	0.682	0.891	1.250
Skewness	1.029	-0.118	-0.035
Kurtosis	0.179	1.980	1.971

Grain Size Description (ASTM-USCS Scale)	Fine sand (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	6.83
Fine Sand	200	72.87
Silt	>0.005 mm	17.64
Clay	<0.005 mm	2.66
	Total	**100**

Phone: (562) 907-3607

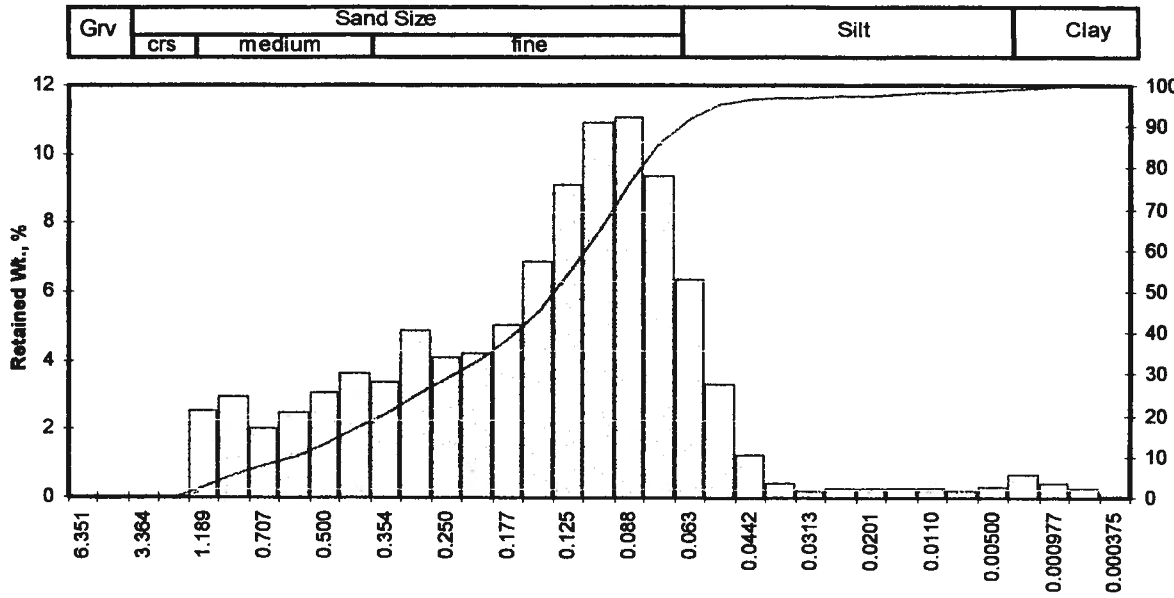
Fax: (562) 907-3610

Appendix D. (Cont.).

Station B2

PTS Laboratories, Inc. **Particle Size Analysis - ASTM D4464M**

Client:	Del Mar Analytical	**PTS File No:**	31584
Project:	N/A	**Sample ID:**	IKJ0326-02
Project No:	IKJ0326	**Depth, ft:**	N/A



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	2.54	2.54	2.54
0.0331	0.841	0.25	20	2.97	2.97	5.51
0.0278	0.707	0.50	25	2.04	2.04	7.55
0.0234	0.595	0.75	30	2.48	2.48	10.03
0.0197	0.500	1.00	35	3.03	3.03	13.06
0.0166	0.420	1.25	40	3.62	3.62	16.68
0.0139	0.354	1.50	45	3.38	3.38	20.06
0.0117	0.297	1.75	50	4.87	4.87	24.93
0.0098	0.250	2.00	60	4.08	4.08	29.01
0.0083	0.210	2.25	70	4.21	4.21	33.21
0.0070	0.177	2.50	80	5.00	5.00	38.21
0.0059	0.149	2.75	100	6.88	6.88	45.09
0.0049	0.125	3.00	120	9.13	9.13	54.22
0.0041	0.105	3.25	140	10.90	10.90	65.12
0.0035	0.088	3.50	170	11.08	11.08	76.20
0.0029	0.074	3.75	200	9.37	9.37	85.57
0.0025	0.063	4.00	230	6.35	6.35	91.91
0.0021	0.053	4.25	270	3.32	3.32	95.23
0.00174	0.0442	4.50	325	1.25	1.25	96.48
0.00146	0.0372	4.75	400	0.41	0.41	96.90
0.00123	0.0313	5.00	450	0.20	0.20	97.10
0.000986	0.0250	5.32	500	0.26	0.26	97.36
0.000790	0.0201	5.64	635	0.26	0.26	97.62
0.000615	0.0156	6.00		0.24	0.24	97.86
0.000435	0.0110	6.50		0.25	0.25	98.11
0.000308	0.00781	7.00		0.22	0.22	98.32
0.000197	0.00500	7.65		0.30	0.29	98.62
0.000077	0.00195	9.00		0.68	0.68	99.30
0.000038	0.000977	10.00		0.44	0.44	99.74
0.000019	0.000488	11.00		0.24	0.24	99.98
0.000015	0.000375	11.38		0.02	0.02	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.16	0.0351	0.892
10	0.75	0.0235	0.596
16	1.20	0.0171	0.434
25	1.75	0.0117	0.296
40	2.56	0.0067	0.169
50	2.88	0.0053	0.135
60	3.13	0.0045	0.114
75	3.47	0.0035	0.090
84	3.71	0.0030	0.077
90	3.92	0.0026	0.066
95	4.23	0.0021	0.053

Measure	Trask	Inman	Folk-Ward
Median, phi	2.88	2.88	2.88
Median, in.	0.0053	0.0053	0.0053
Median, mm	0.135	0.135	0.135
Mean, phi	2.37	2.46	2.60
Mean, in.	0.0076	0.0072	0.0065
Mean, mm	0.193	0.182	0.165
Sorting	0.551	1.252	1.243
Skewness	1.206	-0.342	-0.340
Kurtosis	0.195	0.624	0.970

Grain Size Description (ASTM-USCS Scale)	Fine sand (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	16.68
Fine Sand	200	68.89
Silt	>0.005 mm	13.05
Clay	<0.005 mm	1.38
	Total	100

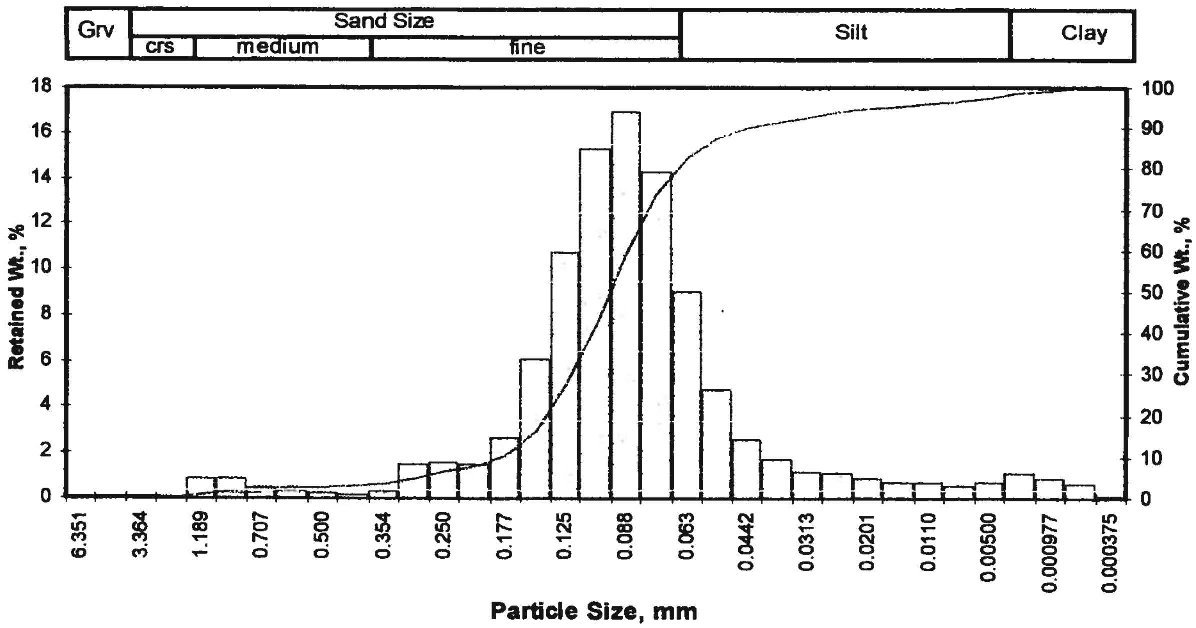
Appendix D. (Cont.).

Station B3

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Del Mar Analytical	**PTS File No:**	31584
Project:	N/A	**Sample ID:**	IKJ0326-03
Project No:	IKJ0326	**Depth, ft:**	N/A



Opening		Phi of	U.S.	Sample	Increment	Cumulative
Inches	Millimeters	Screen	No.	Weight, grams	Weight, percent	Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.87	0.87	0.87
0.0331	0.841	0.25	20	0.88	0.88	1.74
0.0278	0.707	0.50	25	0.47	0.47	2.22
0.0234	0.595	0.75	30	0.33	0.33	2.54
0.0197	0.500	1.00	35	0.22	0.22	2.76
0.0166	0.420	1.25	40	0.18	0.18	2.94
0.0139	0.354	1.50	45	0.30	0.30	3.24
0.0117	0.297	1.75	50	1.48	1.48	4.72
0.0098	0.250	2.00	60	1.57	1.57	6.29
0.0083	0.210	2.25	70	1.45	1.45	7.74
0.0070	0.177	2.50	80	2.61	2.61	10.35
0.0059	0.149	2.75	100	6.06	6.06	16.41
0.0049	0.125	3.00	120	10.73	10.73	27.14
0.0041	0.105	3.25	140	15.29	15.29	42.43
0.0035	0.088	3.50	170	16.92	16.92	59.35
0.0029	0.074	3.75	200	14.24	14.24	73.59
0.0025	0.063	4.00	230	9.01	9.01	82.61
0.0021	0.053	4.25	270	4.72	4.72	87.33
0.00174	0.0442	4.50	325	2.55	2.55	89.88
0.00146	0.0372	4.75	400	1.69	1.69	91.57
0.00123	0.0313	5.00	450	1.20	1.20	92.77
0.000986	0.0250	5.32	500	1.12	1.12	93.89
0.000790	0.0201	5.64	635	0.85	0.85	94.73
0.000615	0.0156	6.00		0.73	0.73	95.46
0.000435	0.0110	6.50		0.70	0.70	96.16
0.000308	0.00781	7.00		0.56	0.56	96.72
0.000197	0.00500	7.65		0.68	0.68	97.40
0.000077	0.00195	9.00		1.11	1.11	98.51
0.000038	0.000977	10.00		0.82	0.82	99.32
0.000019	0.000488	11.00		0.61	0.61	99.94
0.000015	0.000375	11.38		0.06	0.06	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.79	0.0113	0.288
10	2.47	0.0071	0.181
16	2.73	0.0059	0.150
25	2.95	0.0051	0.129
40	3.21	0.0043	0.108
50	3.36	0.0038	0.097
60	3.51	0.0035	0.088
75	3.79	0.0028	0.072
84	4.07	0.0023	0.059
90	4.52	0.0017	0.044
95	5.77	0.0007	0.018

Measure	Trask	Inman	Folk-Ward
Median, phi	3.36	3.36	3.36
Median, in.	0.0038	0.0038	0.0038
Median, mm	0.097	0.097	0.097
Mean, phi	3.31	3.40	3.39
Mean, in.	0.0040	0.0037	0.0038
Mean, mm	0.101	0.095	0.095
Sorting	0.748	0.670	0.938
Skewness	0.995	0.062	0.137
Kurtosis	0.208	1.966	1.943

Grain Size Description (ASTM-USCS Scale)	Fine sand (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	2.94
Fine Sand	200	70.65
Silt	>0.005 mm	23.80
Clay	<0.005 mm	2.60
	Total	**100**

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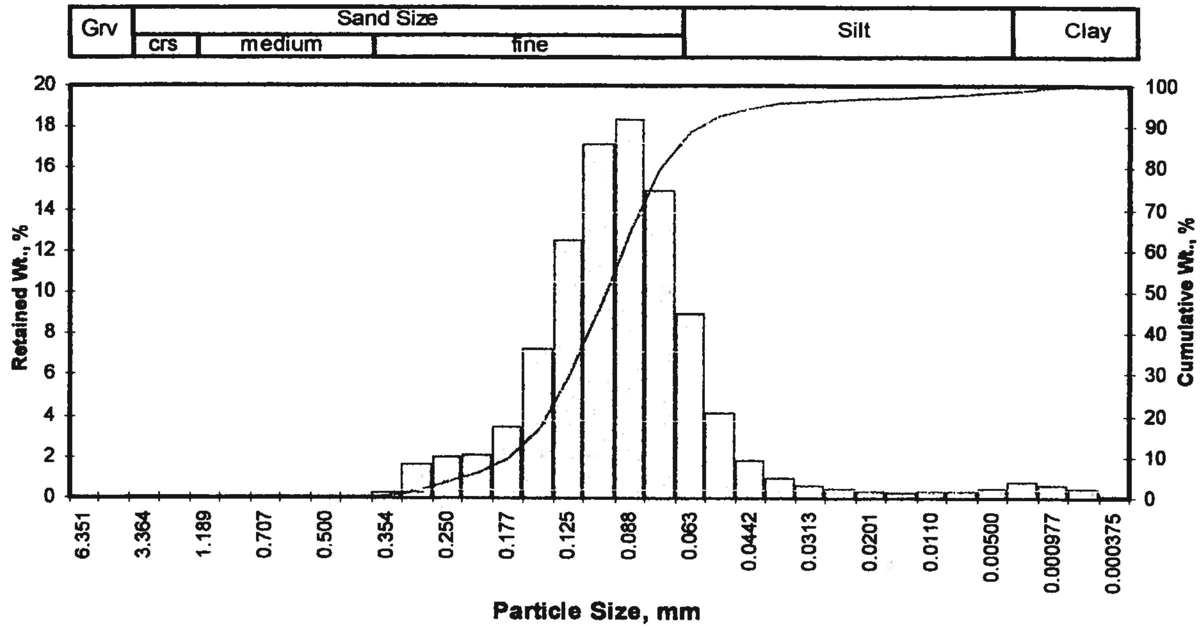
Appendix D. (Cont.).

Station B4

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Del Mar Analytical	**PTS File No:**	31584
Project:	N/A	**Sample ID:**	IKJ0326-04
Project No:	IKJ0326	**Depth, ft:**	N/A



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.01	0.01	0.01
0.0139	0.354	1.50	45	0.26	0.26	0.27
0.0117	0.297	1.75	50	1.63	1.63	1.90
0.0098	0.250	2.00	60	2.00	2.00	3.90
0.0083	0.210	2.25	70	2.11	2.11	6.01
0.0070	0.177	2.50	80	3.44	3.44	9.45
0.0059	0.149	2.75	100	7.28	7.28	16.73
0.0049	0.125	3.00	120	12.47	12.47	29.20
0.0041	0.105	3.25	140	17.17	17.17	46.37
0.0035	0.088	3.50	170	18.33	18.33	64.70
0.0029	0.074	3.75	200	14.91	14.91	79.61
0.0025	0.063	4.00	230	8.98	8.98	88.59
0.0021	0.053	4.25	270	4.18	4.18	92.77
0.00174	0.0442	4.50	325	1.77	1.77	94.54
0.00146	0.0372	4.75	400	0.94	0.94	95.48
0.00123	0.0313	5.00	450	0.57	0.57	96.05
0.000986	0.0250	5.32	500	0.44	0.44	96.49
0.000790	0.0201	5.64	635	0.30	0.30	96.79
0.000615	0.0156	6.00		0.27	0.27	97.06
0.000435	0.0110	6.50		0.31	0.31	97.37
0.000308	0.00781	7.00		0.32	0.32	97.69
0.000197	0.00500	7.65		0.43	0.43	98.12
0.000077	0.00195	9.00		0.78	0.78	98.89
0.000038	0.000977	10.00		0.62	0.62	99.51
0.000019	0.000488	11.00		0.44	0.44	99.95
0.000015	0.000375	11.38		0.05	0.05	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	2.13	0.0090	0.228
10	2.52	0.0069	0.174
16	2.72	0.0060	0.151
25	2.92	0.0052	0.133
40	3.16	0.0044	0.112
50	3.30	0.0040	0.102
60	3.44	0.0036	0.092
75	3.67	0.0031	0.078
84	3.87	0.0027	0.068
90	4.08	0.0023	0.059
95	4.62	0.0016	0.041

Measure	Trask	Inman	Folk-Ward
Median, phi	3.30	3.30	3.30
Median, in.	0.0040	0.0040	0.0040
Median, mm	0.102	0.102	0.102
Mean, phi	3.25	3.30	3.30
Mean, in.	0.0042	0.0040	0.0040
Mean, mm	0.105	0.102	0.102
Sorting	0.769	0.574	0.664
Skewness	1.004	-0.002	0.030
Kurtosis	0.234	1.172	1.349

Grain Size Description (ASTM-USCS Scale)	Fine sand (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.01
Fine Sand	200	79.60
Silt	>0.005 mm	18.51
Clay	<0.005 mm	1.88
	Total	100

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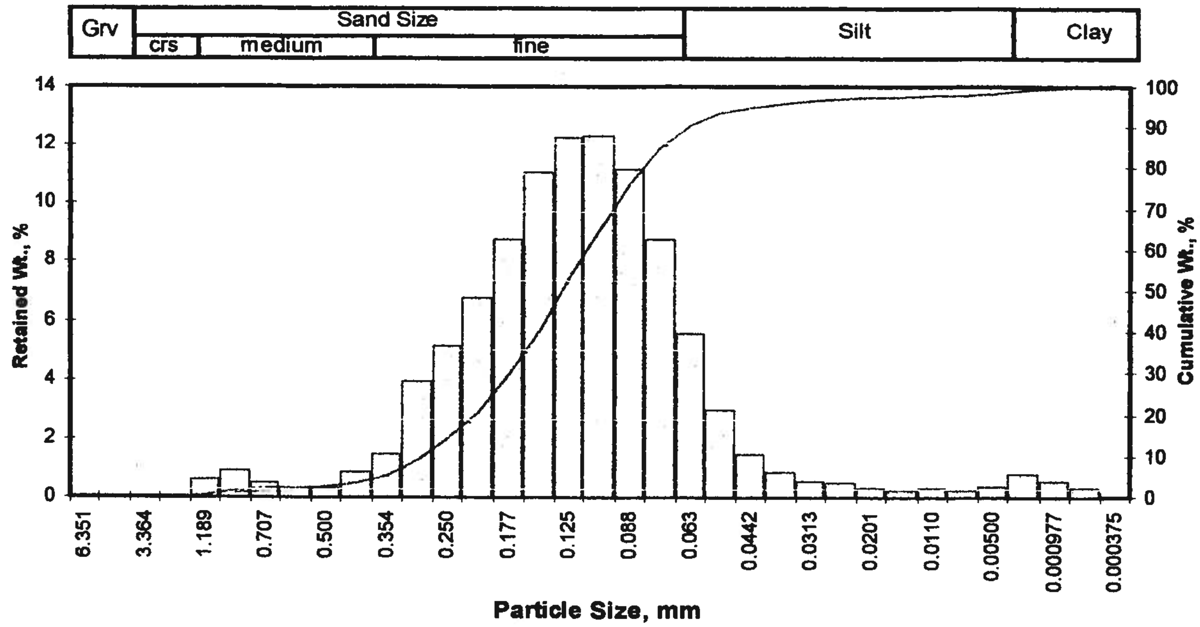
Appendix D. (Cont.).

Station B5

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Del Mar Analytical	**PTS File No:**	31584
Project:	N/A	**Sample ID:**	IKJ0326-05
Project No:	IKJ0326	**Depth, ft:**	N/A



Opening		Phi of	U.S.	Sample Weight,	Increment Weight,	Cumulative Weight,
Inches	Millimeters	Screen	No.	grams	percent	percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.62	0.62	0.62
0.0331	0.841	0.25	20	0.92	0.92	1.54
0.0278	0.707	0.50	25	0.47	0.47	2.01
0.0234	0.595	0.75	30	0.32	0.32	2.33
0.0197	0.500	1.00	35	0.33	0.33	2.66
0.0166	0.420	1.25	40	0.84	0.84	3.50
0.0139	0.354	1.50	45	1.47	1.47	4.97
0.0117	0.297	1.75	50	3.94	3.94	8.91
0.0098	0.250	2.00	60	5.12	5.12	14.03
0.0083	0.210	2.25	70	6.78	6.78	20.81
0.0070	0.177	2.50	80	8.77	8.77	29.58
0.0059	0.149	2.75	100	11.04	11.04	40.62
0.0049	0.125	3.00	120	12.22	12.22	52.84
0.0041	0.105	3.25	140	12.32	12.32	65.16
0.0035	0.088	3.50	170	11.15	11.15	76.31
0.0029	0.074	3.75	200	8.75	8.75	85.06
0.0025	0.063	4.00	230	5.58	5.58	90.64
0.0021	0.053	4.25	270	2.93	2.93	93.57
0.00174	0.0442	4.50	325	1.44	1.44	95.01
0.00146	0.0372	4.75	400	0.84	0.84	95.86
0.00123	0.0313	5.00	450	0.56	0.56	96.41
0.000986	0.0250	5.32	500	0.48	0.48	96.89
0.000790	0.0201	5.64	635	0.32	0.32	97.21
0.000615	0.0156	6.00		0.27	0.27	97.49
0.000435	0.0110	6.50		0.29	0.29	97.78
0.000308	0.00781	7.00		0.27	0.27	98.05
0.000197	0.00500	7.65		0.35	0.35	98.39
0.000077	0.00195	9.00		0.76	0.76	99.15
0.000038	0.000977	10.00		0.52	0.52	99.67
0.000019	0.000488	11.00		0.30	0.30	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				100.00	100.00	100.00

Cumulative Weight Percent greater than			
Weight	Phi	Particle Size	
percent	Value	Inches	Millimeters
5	1.50	0.0139	0.353
10	1.80	0.0113	0.287
16	2.07	0.0094	0.238
25	2.37	0.0076	0.194
40	2.74	0.0059	0.150
50	2.94	0.0051	0.130
60	3.15	0.0044	0.113
75	3.47	0.0036	0.090
84	3.72	0.0030	0.076
90	3.97	0.0025	0.064
95	4.50	0.0017	0.044

Measure	Trask	Inman	Folk-Ward
Median, phi	2.94	2.94	2.94
Median, in.	0.0051	0.0051	0.0051
Median, mm	0.130	0.130	0.130
Mean, phi	2.82	2.90	2.91
Mean, in.	0.0056	0.0053	0.0052
Mean, mm	0.142	0.134	0.133
Sorting	0.683	0.823	0.866
Skewness	1.015	-0.056	-0.008
Kurtosis	0.232	0.819	1.115
Grain Size Description (ASTM-USCS Scale)			Fine sand (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	3.50
Fine Sand	200	81.56
Silt	>0.005 mm	13.33
Clay	<0.005 mm	1.61
	Total	100

Phone: (562) 907-3607 Fax: (562) 907-3610

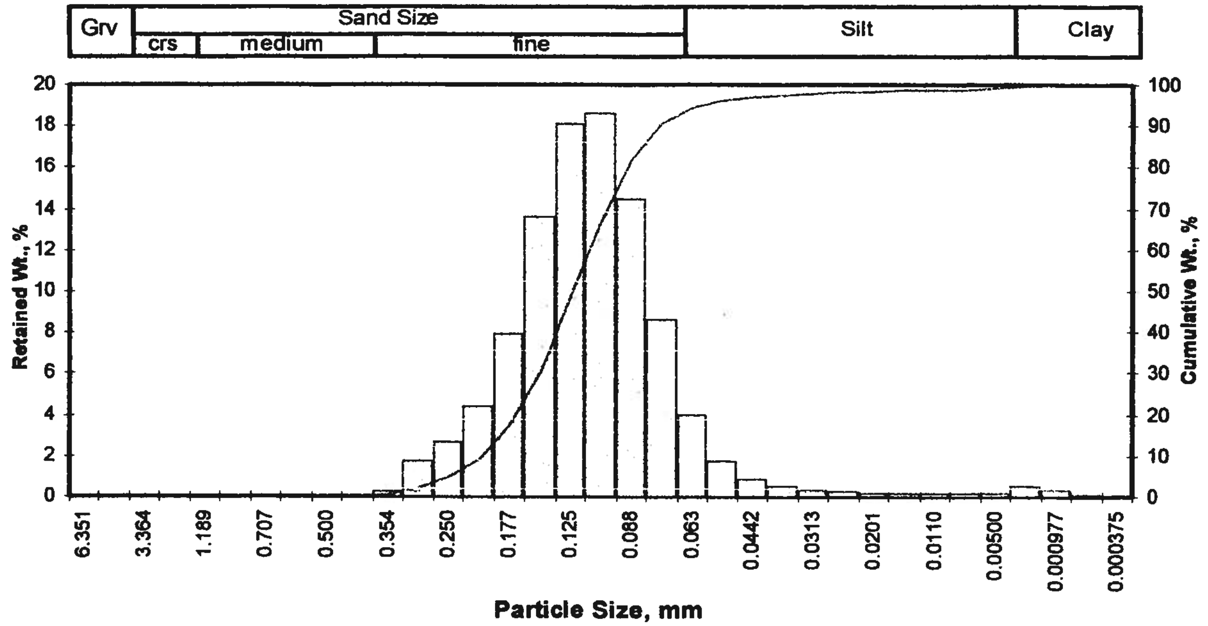
Appendix D. (Cont.).

Station B6

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Del Mar Analytical	**PTS File No:**	31584
Project:	N/A	**Sample ID:**	IKJ0326-06
Project No:	IKJ0326	**Depth, ft:**	N/A



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.01	0.01	0.01
0.0139	0.354	1.50	45	0.30	0.30	0.30
0.0117	0.297	1.75	50	1.76	1.76	2.06
0.0098	0.250	2.00	60	2.71	2.71	4.77
0.0083	0.210	2.25	70	4.37	4.37	9.14
0.0070	0.177	2.50	80	7.90	7.90	17.04
0.0059	0.149	2.75	100	13.66	13.66	30.70
0.0049	0.125	3.00	120	18.11	18.11	48.81
0.0041	0.105	3.25	140	18.60	18.60	67.41
0.0035	0.088	3.50	170	14.50	14.50	81.91
0.0029	0.074	3.75	200	8.60	8.60	90.51
0.0025	0.063	4.00	230	3.96	3.96	94.47
0.0021	0.053	4.25	270	1.69	1.69	96.16
0.00174	0.0442	4.50	325	0.88	0.87	97.03
0.00146	0.0372	4.75	400	0.55	0.55	97.58
0.00123	0.0313	5.00	450	0.33	0.33	97.91
0.000986	0.0250	5.32	500	0.25	0.25	98.16
0.000790	0.0201	5.64	635	0.18	0.18	98.34
0.000615	0.0156	6.00		0.17	0.17	98.50
0.000435	0.0110	6.50		0.18	0.18	98.68
0.000308	0.00781	7.00		0.14	0.14	98.82
0.000197	0.00500	7.65		0.17	0.17	99.00
0.000077	0.00195	9.00		0.50	0.50	99.50
0.000038	0.000977	10.00		0.38	0.38	99.87
0.000019	0.000488	11.00		0.13	0.13	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				100.00	100.00	100.00

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	2.01	0.0098	0.248
10	2.28	0.0081	0.206
16	2.47	0.0071	0.181
25	2.65	0.0063	0.160
40	2.88	0.0054	0.136
50	3.02	0.0049	0.124
60	3.15	0.0044	0.113
75	3.38	0.0038	0.096
84	3.56	0.0033	0.085
90	3.74	0.0030	0.075
95	4.08	0.0023	0.059

Measure	Trask	Inman	Folk-Ward
Median, phi	3.02	3.02	3.02
Median, in.	0.0049	0.0049	0.0049
Median, mm	0.124	0.124	0.124
Mean, phi	2.97	3.01	3.01
Mean, in.	0.0050	0.0049	0.0049
Mean, mm	0.128	0.124	0.124
Sorting	0.775	0.547	0.586
Skewness	1.002	-0.004	0.012
Kurtosis	0.243	0.888	1.151

Grain Size Description (ASTM-USCS Scale)	Fine sand (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.01
Fine Sand	200	90.50
Silt	>0.005 mm	8.49
Clay	<0.005 mm	1.00
	Total	100

Appendix D-1. Yearly grain size values, 1990 - 2001. Reliant Energy Ormond Beach generating station NPDES, 2001.

						Mean grain size				
Year	Station	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	phi	μm	Sorting	Skewness	Kurtosis
2001	B1	0.00	86.36	10.98	2.66	3.06	120	1.25	-0.04	1.97
	B2	0.00	91.91	6.71	1.38	2.60	165	1.24	-0.34	0.97
	B3	0.00	82.61	14.79	2.60	3.39	95	0.94	0.14	1.94
	B4	0.00	88.59	9.53	1.88	3.30	102	0.66	0.03	1.35
	B5	0.00	90.64	7.75	1.61	2.91	133	0.87	-0.01	1.12
	B6	0.00	94.47	4.53	1.00	3.01	124	0.59	0.01	1.15
2000	B1	0.00	84.99	13.01	2.00	3.31	101	0.81	0.09	1.50
	B2	0.00	85.76	12.58	1.66	3.44	92	0.60	0.03	1.30
	B3	0.00	92.90	5.73	1.37	2.87	137	0.79	-0.03	1.10
	B4	0.00	90.23	8.39	1.38	3.21	108	0.67	-0.03	1.21
	B5	0.00	90.54	7.84	1.62	2.95	129	0.81	0.10	1.14
	B6	0.00	96.03	3.04	0.93	2.72	152	0.59	0.01	1.15
1999	B1	0.00	84.36	13.08	2.56	3.14	113	1.08	0.07	1.63
	B2	0.00	86.01	11.82	2.17	3.10	117	1.16	-0.13	1.82
	B3	0.00	89.90	7.87	2.23	3.24	106	0.61	0.17	1.23
	B4	0.00	90.55	7.83	1.62	2.90	134	0.92	-0.11	1.16
	B5	0.00	91.09	7.27	1.64	2.88	136	0.85	0.06	1.23
	B6	0.00	95.66	3.34	1.00	2.80	144	0.71	-0.12	1.11
1998	B1	0.27	78.33	19.63	1.76	3.66	79	62.10	0.02	1.45
	B2	0.41	91.15	7.08	1.36	3.13	114	60.81	0.07	1.30
	B3	0.67	81.94	15.28	2.11	3.47	90	59.27	-0.09	1.39
	B4	-	-	-	-	-	-	-	-	-
	B5	-	-	-	-	-	-	-	-	-
	B6	-	-	-	-	-	-	-	-	-
1997	B1	0.44	86.56	11.41	1.58	3.37	97	61.85	-0.01	1.26
	B2	0.00	83.63	14.79	1.58	3.57	84	63.73	-0.10	1.46
	B3	0.39	93.45	4.30	1.86	2.34	198	48.90	0.12	0.88
	B4	0.02	85.99	11.84	2.15	3.47	90	63.41	-0.06	1.33
	B5	0.29	90.33	7.75	1.63	3.09	118	58.55	0.16	1.20
	B6	0.30	95.00	3.47	1.23	3.02	124	61.02	-0.12	1.03
1994	B1	0.33	84.21	15.46	0.00	3.35	98	64.36	-0.17	1.00
	B2	0.00	81.66	18.34	0.00	3.57	84	72.11	-0.11	1.12
	B3	0.06	97.55	2.31	0.07	2.05	241	63.01	0.04	1.15
	B4	0.00	86.52	13.28	0.20	3.30	102	65.07	-0.18	1.06
	B5	3.17	88.41	7.87	0.54	2.95	129	59.27	-0.11	1.12
	B6	0.33	94.86	4.71	0.10	3.30	102	76.01	-0.06	0.92
1993	B1	0.89	95.27	3.20	0.64	2.60	165	N.A.	N.A.	N.A.
	B2	0.00	98.96	0.52	0.52	2.21	216	N.A.	N.A.	N.A.
	B3	11.45	86.26	1.64	0.65	1.93	262	N.A.	N.A.	N.A.
	B4	3.96	92.91	2.69	0.45	2.48	179	N.A.	N.A.	N.A.
	B5	0.99	96.05	2.22	0.74	2.20	217	N.A.	N.A.	N.A.
	B6	0.28	98.41	0.44	0.87	2.57	168	N.A.	N.A.	N.A.
1992	B1	0.58	88.55	10.23	0.64	3.18	110	N.A.	N.A.	N.A.
	B2	0.04	94.23	4.59	1.15	3.00	125	N.A.	N.A.	N.A.
	B3	0.73	93.57	5.13	0.57	2.98	127	N.A.	N.A.	N.A.
	B4	1.44	90.47	7.28	0.81	3.10	117	N.A.	N.A.	N.A.
	B5	2.18	91.68	5.41	0.72	2.78	146	N.A.	N.A.	N.A.
	B6	6.81	92.28	0.69	0.23	2.62	163	N.A.	N.A.	N.A.
1991	B1	1.15	88.18	9.07	1.60	2.70	154	N.A.	N.A.	N.A.
	B2	0.01	91.72	7.17	1.10	2.70	154	N.A.	N.A.	N.A.
	B3	4.97	82.31	5.53	1.01	1.38	380	N.A.	N.A.	N.A.
	B4	0.83	89.46	8.00	1.71	2.80	144	N.A.	N.A.	N.A.
	B5	0.09	88.21	9.94	1.75	2.88	136	N.A.	N.A.	N.A.
	B6	0.57	92.83	5.50	1.10	2.90	134	N.A.	N.A.	N.A.
1990	B1	1.31	82.68	15.57	0.43	3.13	114	58.38	0.09	1.25
	B2	13.65	69.89	15.93	0.53	1.95	258	35.96	-0.60	1.67
	B3	0.00	93.06	6.25	0.69	2.93	131	66.26	0.11	1.41
	B4	0.00	82.05	17.81	0.14	3.55	86	71.74	0.26	0.98
	B5	0.00	95.32	4.00	0.68	2.74	150	70.61	0.12	1.39
	B6	0.22	93.36	6.02	0.40	2.82	142	60.83	-0.14	0.99

N.A. = Not Available
- = Not Sampled

APPENDIX E

Sediment chemistry by station

Del Mar Analytical

2852 Alton Ave., Irvine, CA 92606 (949) 261-1022 FAX (949) 261-1228
1014 E. Coldby Dr., Suite A, Colton, CA 92324 (909) 370-4667 FAX (909) 370-1046
7277 Hayvenhurst, Suite B-12, Van Nuys, CA 91406 (818) 779-1844 FAX (818) 779-1843
9484 Chesapeake Dr., Suite 805, San Diego, CA 92123 (858) 505-8596 FAX (858) 505-9589
9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851

MBC Applied Env. Sciences
3000 Redhill Avenue
Costa Mesa, CA 92626-4524
Attention: Mike Curtis

Project ID: 01203A/Reliant OBGS

Report Number: IKH0006

Sampled: 07/25/01
Received: 08/01/01

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
			mg/kg dry	mg/kg dry				
Sample ID: IKH0006-01 (B1 (I,II,III) - Solid)								
Chromium	EPA 6010B	I1H0625	1.6	**13**	1	8/6/01	8/6/01	
Copper	EPA 6010B	I1H0625	1.6	**4.3**	1	8/6/01	8/6/01	
Nickel	EPA 6010B	I1H0625	1.6	**8.8**	1	8/6/01	8/6/01	
Zinc	EPA 6010B	I1H0625	8.0	**20**	1	8/6/01	8/6/01	
Sample ID: IKH0006-02 (B2 (I,II,III) - Solid)								
Chromium	EPA 6010B	I1H0625	1.4	**12**	1	8/6/01	8/6/01	
Copper	EPA 6010B	I1H0625	1.4	**4.0**	1	8/6/01	8/6/01	
Nickel	EPA 6010B	I1H0625	1.4	**8.0**	1	8/6/01	8/6/01	
Zinc	EPA 6010B	I1H0625	7.2	**19**	1	8/6/01	8/6/01	
Sample ID: IKH0006-03 (B3 (I,II,III) - Solid)								
Chromium	EPA 6010B	I1H0625	1.6	**9.9**	1	8/6/01	8/6/01	
Copper	EPA 6010B	I1H0625	1.6	**3.5**	1	8/6/01	8/6/01	
Nickel	EPA 6010B	I1H0625	1.6	**6.9**	1	8/6/01	8/6/01	
Zinc	EPA 6010B	I1H0625	7.8	**16**	1	8/6/01	8/6/01	
Sample ID: IKH0006-04 (B4 (I,II,III) - Solid)								
Chromium	EPA 6010B	I1H0625	1.4	**14**	1	8/6/01	8/6/01	
Copper	EPA 6010B	I1H0625	1.4	**4.5**	1	8/6/01	8/6/01	
Nickel	EPA 6010B	I1H0625	1.4	**9.5**	1	8/6/01	8/6/01	
Zinc	EPA 6010B	I1H0625	6.9	**23**	1	8/6/01	8/6/01	

Del Mar Analytical, Irvine
Xuan Huong Dang
Project Manager

Del Mar Analytical

2852 Alton Ave., Irvine, CA 92606 (949) 261-1022 FAX (949) 261-1
1014 E. Coldby Dr., Suite A, Colton, CA 92324 (909) 370-4667 FAX (909) 370-1
7277 Hayvenhurst, Suite B-12, Van Nuys, CA 91406 (818) 779-1844 FAX (818) 779-1843
9484 Chesapeake Dr., Suite 805, San Diego, CA 92123 (858) 505-8596 FAX (858) 505-9589
9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851

MBC Applied Env. Sciences
3000 Redhill Avenue
Costa Mesa, CA 92626-4524
Attention: Mike Curtis

Project ID: 01203A/Reliant OBGS

Report Number: IKH0006

Sampled: 07/25/01
Received: 08/01/01

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
			mg/kg dry	mg/kg dry				
Sample ID: IKH0006-05 (B5 (I,II,III) - Solid)								
Chromium	EPA 6010B	I1H0625	1.6	**15**	1	8/6/01	8/6/01	
Copper	EPA 6010B	I1H0625	1.6	**6.4**	1	8/6/01	8/6/01	
Nickel	EPA 6010B	I1H0625	1.6	**8.6**	1	8/6/01	8/6/01	
Zinc	EPA 6010B	I1H0625	7.8	**26**	1	8/6/01	8/6/01	
Sample ID: IKH0006-06 (B6 (I,II,III) - Solid)								
Chromium	EPA 6010B	I1H0625	1.5	**9.6**	1	8/6/01	8/6/01	
Copper	EPA 6010B	I1H0625	1.5	**3.8**	1	8/6/01	8/6/01	
Nickel	EPA 6010B	I1H0625	1.5	**7.4**	1	8/6/01	8/6/01	
Zinc	EPA 6010B	I1H0625	7.4	**21**	1	8/6/01	8/6/01	

Del Mar Analytical, Irvine
Xuan Huong Dang
Project Manager

Del Mar Analytical

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9830 South 51st St., Suite B-120, Phoenix, AZ 85044 (480) 785-0043 FAX (480) 785-0851

MBC Applied Env. Sciences
3000 Redhill Avenue
Costa Mesa, CA 92626-4524
Attention: Mike Curtis

Project ID: 01203A/Reliant OBGS

Report Number: IKH0006

Sampled: 07/25/01
Received: 08/01/01

INORGANICS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
			%	%				
Sample ID: IKH0006-01 (B1 (I,II,III) - Solid)								
Percent Solids	EPA 160.3 MOD	I1H0657	0.010	**63**	1	8/6/01	8/6/01	
Sample ID: IKH0006-02 (B2 (I,II,III) - Solid)								
Percent Solids	EPA 160.3 MOD	I1H0657	0.010	**70**	1	8/6/01	8/6/01	
Sample ID: IKH0006-03 (B3 (I,II,III) - Solid)								
Percent Solids	EPA 160.3 MOD	I1H0657	0.010	**64**	1	8/6/01	8/6/01	
Sample ID: IKH0006-04 (B4 (I,II,III) - Solid)								
Percent Solids	EPA 160.3 MOD	I1H0657	0.010	**72**	1	8/6/01	8/6/01	
Sample ID: IKH0006-05 (B5 (I,II,III) - Solid)								
Percent Solids	EPA 160.3 MOD	I1H0657	0.010	**64**	1	8/6/01	8/6/01	
Sample ID: IKH0006-06 (B6 (I,II,III) - Solid)								
Percent Solids	EPA 160.3 MOD	I1H0657	0.010	**68**	1	8/6/01	8/6/01	

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MBC Applied Env. Sciences
3000 Redhill Avenue
Costa Mesa, CA 92626-4524
Attention: Mike Curtis

Project ID: 01203A/Reliant OBGS

Report Number: IKH0006

Sampled: 07/25/01
Received: 08/01/01

METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: I1H0625 Extracted: 08/06/01										
Blank Analyzed: 08/06/01 (I1H0625-BLK1)										
Chromium	ND	1.0	mg/kg wet							
Copper	ND	1.0	mg/kg wet							
Nickel	ND	1.0	mg/kg wet							
Zinc	ND	5.0	mg/kg wet							
LCS Analyzed: 08/06/01 (I1H0625-BS1)										
Chromium	45.2	1.0	mg/kg wet	50.0		90.4	80-120			
Copper	45.0	1.0	mg/kg wet	50.0		90.0	80-120			
Nickel	44.6	1.0	mg/kg wet	50.0		89.2	80-120			
Zinc	44.1	5.0	mg/kg wet	50.0		88.2	80-120			
Matrix Spike Analyzed: 08/06/01 (I1H0625-MS1)					**Source: IKH0071-01**					
Chromium	51.4	1.0	mg/kg wet	50.0	7.1	88.6	75-125			
Copper	67.2	1.0	mg/kg wet	50.0	22	90.4	75-125			
Nickel	59.0	1.0	mg/kg wet	50.0	25	68.0	75-125			*M2*
Zinc	77.2	5.0	mg/kg wet	50.0	35	84.4	75-125			
Matrix Spike Dup Analyzed: 08/06/01 (I1H0625-MSD1)					**Source: IKH0071-01**					
Chromium	51.0	1.0	mg/kg wet	50.0	7.1	87.8	75-125	0.781	20	
Copper	62.8	1.0	mg/kg wet	50.0	22	81.6	75-125	6.77	20	
Nickel	58.5	1.0	mg/kg wet	50.0	25	67.0	75-125	0.851	20	*M2*
Zinc	73.8	5.0	mg/kg wet	50.0	35	77.6	75-125	4.50	20	

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Project ID: 01203A/Reliant OBGS
Report Number: IKH0006

Sampled: 07/25/01
Received: 08/01/01

METHOD BLANK/QC DATA

INORGANICS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: I1H0657 Extracted: 08/06/01										
Blank Analyzed: 08/06/01 (I1H0657-BLK1)										
Percent Solids	ND	0.010	%							
Duplicate Analyzed: 08/06/01 (I1H0657-DUP1)					**Source: IKH0005-01**					
Percent Solids	65.6	0.010	%		66			0.608	20	

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Project ID: 01203A/Reliant OBGS

Report Number: IKH0006

Sampled: 07/25/01
Received: 08/01/01

DATA QUALIFIERS AND DEFINITIONS

M2	The MS and/or MSD were below the acceptance limits due to sample matrix interference. See Blank Spike (LCS).
ND	Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.
NR	Not reported.
RPD	Relative Percent Difference

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Project Manager

Appendix E-1. Yearly sediment metal concentrations, 1990 - 2001. Reliant Energy Ormond Beach generating station NPDES, 2001.

Metal	Station	1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	Mean
		Year										
Chromium	B1	9.9	19.3	10.0	8.8	10.0	8.6	-	6.9	10.0	13	10.7
ERL = 81	B2	9.3	37.5	9.6	8.9	10.0	9.4	8.1	9.9	9.0	12	12.4
	B3	7.4	13.3	5.7	9.1	12.0	6.1	5.8	10.0	11.0	9.9	9.0
	B4	8.0	17.7	9.6	8.8	7.9	7.9	7.9	7.8	10.0	14	10.0
	B5	8.2	17.3	8.6	7.8	8.6	8.0	-	7.4	6.1	15	9.7
	B6	5.9	10.8	8.4	8.0	9.9	5.4	-	7.8	10.0	9.6	8.4
Copper	B1	2.9	8.8	5.0	4.2	4.3	1.6	-	3.9	3.9	4.3	4.3
ERL = 34	B2	2.2	24.3	5.0	4.1	4.5	2.0	3.5	4.7	4.1	4.0	5.8
	B3	1.6	10.6	10.4	5.4	4.3	1.5	3.1	4.2	20.0	3.5	6.5
	B4	1.7	11.1	5.2	4.6	3.9	1.3	3.0	4.3	4.1	4.5	4.4
	B5	2.4	11.2	5.0	4.4	4.3	1.8	-	4.1	3.6	6.4	4.8
	B6	1.3	6.0	4.9	4.1	5.1	0.0	-	4.7	3.9	3.8	3.8
Nickel	B1	5.7	13.2	7.2	6.6	6.2	6.0	-	5.7	6.9	8.8	7.4
ERL = 21	B2	5.7	20.0	7.3	6.1	6.3	7.2	3.6	7.7	6.8	8.0	7.9
	B3	4.4	8.4	8.4	6.9	8.2	4.4	3.6	7.7	6.1	6.9	6.5
	B4	4.8	11.6	7.4	7.1	5.6	5.8	4.0	7.0	7.1	9.5	7.0
	B5	5.3	13.1	6.7	6.4	6.1	5.5	-	6.1	5.7	8.6	7.1
	B6	3.9	8.4	7.4	6.9	7.1	4.8	-	7.6	8.2	7.4	6.9
Zinc	B1	20.0	28.1	21.8	23	21	23	-	21	26	20	22.7
ERL = 150	B2	18.9	32.5	22.5	22	22	25	15	27	25	19	22.9
	B3	15.7	13.0	25.9	23	16	14	14	26	31	16	19.5
	B4	16.7	22.6	23.4	22	19	20	14	23	27	23	21.1
	B5	17.6	37.3	20.5	21	21	21	-	20	22	26	22.9
	B6	13.0	23.3	20.3	20	24	15	-	19	27	21	20.3
Fines	B1	15.6	10.7	10.9	3.8	15.5	13.0	-	15.6	15.01	13.64	12.6
	B2	15.9	8.3	5.7	1.0	18.3	16.4	21.4	14.0	14.24	8.09	12.3
	B3	6.9	6.6	5.7	2.3	2.3	6.2	8.4	10.1	7.10	17.39	7.3
	B4	18.0	9.7	8.1	3.1	13.3	14.0	17.4	9.5	9.77	11.41	11.4
	B5	4.7	11.7	6.1	3.0	8.4	9.4	-	8.9	9.46	9.36	7.9
	B6	6.0	6.6	0.9	1.3	4.7	4.7	-	4.3	3.97	5.53	4.2

ERL = Effects Range Low
\- = not sampled

APPENDIX F

Mussel tissue chemistry by station

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MBC Applied Env. Sciences
3000 Redhill Avenue
Costa Mesa, CA 92626-4524
Attention: Mike Curtis

Project ID: OBGS NPDES 01203A

Report Number: IKJ1097

Sampled: 10/19/01
Received: 10/26/01

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
			mg/kg dry	mg/kg dry				
Sample ID: IKJ1097-01 (MT-OB I - Solid)								
Chromium	EPA 6010B	11J3046	5.4	ND	1	10/30/01	10/31/01	
Copper	EPA 6010B	11J3046	5.4	**8.7**	1	10/30/01	10/31/01	
Nickel	EPA 6010B	11J3046	5.4	ND	1	10/30/01	10/31/01	
Zinc	EPA 6010B	11J3046	27	**77**	1	10/30/01	10/31/01	
Sample ID: IKJ1097-02 (MT-OB II - Solid)								
Chromium	EPA 6010B	11J3046	6.1	ND	1	10/30/01	10/31/01	
Copper	EPA 6010B	11J3046	6.1	**7.0**	1	10/30/01	10/31/01	
Nickel	EPA 6010B	11J3046	6.1	ND	1	10/30/01	10/31/01	
Zinc	EPA 6010B	11J3046	30	**96**	1	10/30/01	10/31/01	
Sample ID: IKJ1097-03 (MT-OB III - Solid)								
Chromium	EPA 6010B	11J3046	6.7	ND	1	10/30/01	10/31/01	
Copper	EPA 6010B	11J3046	6.7	**8.3**	1	10/30/01	10/31/01	
Nickel	EPA 6010B	11J3046	6.7	ND	1	10/30/01	10/31/01	
Zinc	EPA 6010B	11J3046	34	**150**	1	10/30/01	10/31/01	

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Attention: Mike Curtis

Project ID: OBGS NPDES 01203A

Report Number: IKJ1097

Sampled: 10/19/01
Received: 10/26/01

INORGANICS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
			%	%				
Sample ID: IKJ1097-01 (MT-OB I - Solid)								
Percent Solids	EPA 160.3 MOD	I1J2975	0.010	**19**	1	10/29/01	10/29/01	
Sample ID: IKJ1097-02 (MT-OB II - Solid)								
Percent Solids	EPA 160.3 MOD	I1J2975	0.010	**17**	1	10/29/01	10/29/01	
Sample ID: IKJ1097-03 (MT-OB III - Solid)								
Percent Solids	EPA 160.3 MOD	I1J2975	0.010	**15**	1	10/29/01	10/29/01	

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MBC Applied Env. Sciences
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Attention: Mike Curtis

Project ID: OBGS NPDES 01203A

Report Number: IKJ1097

Sampled: 10/19/01
Received: 10/26/01

METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: I1J3046 Extracted: 10/30/01										
Blank Analyzed: 10/31/01 (I1J3046-BLK1)										
Chromium	ND	1.0	mg/kg wet							
Copper	ND	1.0	mg/kg wet							
Nickel	ND	1.0	mg/kg wet							
Zinc	ND	5.0	mg/kg wet							
LCS Analyzed: 10/31/01 (I1J3046-BS1)										
Chromium	48.9	1.0	mg/kg wet	50.0		97.8	80-120			
Copper	47.8	1.0	mg/kg wet	50.0		95.6	80-120			
Nickel	48.8	1.0	mg/kg wet	50.0		97.6	80-120			
Zinc	48.3	5.0	mg/kg wet	50.0		96.6	80-120			
Matrix Spike Analyzed: 10/31/01 (I1J3046-MS1)					**Source: IKJ1141-06**					
Chromium	139	1.0	mg/kg wet	50.0	88	102	75-125			
Copper	148	1.0	mg/kg wet	50.0	91	114	75-125			
Nickel	74.6	1.0	mg/kg wet	50.0	26	97.2	75-125			
Zinc	387	5.0	mg/kg wet	50.0	330	114	75-125			
Matrix Spike Dup Analyzed: 10/31/01 (I1J3046-MSD1)					**Source: IKJ1141-06**					
Chromium	136	1.0	mg/kg wet	50.0	88	96.0	75-125	2.18	20	
Copper	144	1.0	mg/kg wet	50.0	91	106	75-125	2.74	20	
Nickel	74.0	1.0	mg/kg wet	50.0	26	96.0	75-125	0.808	20	
Zinc	370	5.0	mg/kg wet	50.0	330	80.0	75-125	4.49	20	

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Attention: Mike Curtis

Project ID: OBGS NPDES 01203A

Report Number: IKJ1097

Sampled: 10/19/01
Received: 10/26/01

METHOD BLANK/QC DATA

INORGANICS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: I1J2975 Extracted: 10/29/01										
Blank Analyzed: 10/29/01 (I1J2975-BLK1)										
Percent Solids	ND	0.010	%							
Duplicate Analyzed: 10/29/01 (I1J2975-DUP1)					**Source: IKJ0978-01**					
Percent Solids	12.4	0.010	%		12			3.28	20	

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Attention: Mike Curtis

Project ID: OBGS NPDES 01203A

Report Number: IKJ1097

Sampled: 10/19/01
Received: 10/26/01

DATA QUALIFIERS AND DEFINITIONS

ND Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.

NR Not reported.

RPD Relative Percent Difference

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Project ID: 01204A Catalina NPDES

Report Number: IKJ1098

Sampled: 10/19/01
Received: 10/26/01

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
			mg/kg dry	mg/kg dry				
Sample ID: IKJ1098-04 (MT-MNC I - Solid)								
Chromium	EPA 6010B	11J3081	7.9	ND	1	10/30/01	10/31/01	
Copper	EPA 6010B	11J3081	7.9	**13**	1	10/30/01	10/31/01	
Nickel	EPA 6010B	11J3081	7.9	ND	1	10/30/01	10/31/01	
Zinc	EPA 6010B	11J3081	40	**270**	1	10/30/01	10/31/01	
Sample ID: IKJ1098-05 (MT-MNC II - Solid)								
Chromium	EPA 6010B	11J3140	7.4	ND	1	10/31/01	11/2/01	
Copper	EPA 6010B	11J3140	7.4	**16**	1	10/31/01	11/2/01	
Nickel	EPA 6010B	11J3140	7.4	ND	1	10/31/01	11/2/01	
Zinc	EPA 6010B	11J3140	37	**170**	1	10/31/01	11/2/01	
Sample ID: IKJ1098-06 (MT-MNC III - Solid)								
Chromium	EPA 6010B	11J3140	9.5	ND	1	10/31/01	11/2/01	
Copper	EPA 6010B	11J3140	9.5	**16**	1	10/31/01	11/2/01	
Nickel	EPA 6010B	11J3140	9.5	ND	1	10/31/01	11/2/01	
Zinc	EPA 6010B	11J3140	47	**250**	1	10/31/01	11/2/01	

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Costa Mesa, CA 92626-4524
Attention: Mike Curtis

Project ID: 01204A Catalina NPDES

Report Number: IKJ1098

Sampled: 10/19/01
Received: 10/26/01

INORGANICS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
			%	%				
Sample ID: IKJ1098-04 (MT-MNC I - Solid)								
Percent Solids	EPA 160.3 MOD	I1J2975	0.010	13	1	10/29/01	10/29/01	
Sample ID: IKJ1098-05 (MT-MNC II - Solid)								
Percent Solids	EPA 160.3 MOD	I1J2975	0.010	14	1	10/29/01	10/29/01	
Sample ID: IKJ1098-06 (MT-MNC III - Solid)								
Percent Solids	EPA 160.3 MOD	I1J2975	0.010	11	1	10/29/01	10/29/01	

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Project ID: 01204A Catalina NPDES

Report Number: IKJ1098

Sampled: 10/19/01
Received: 10/26/01

METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: I1J3081 Extracted: 10/30/01										
Blank Analyzed: 11/01/01 (I1J3081-BLK1)										
Chromium	ND	1.0	mg/kg wet							
Copper	ND	1.0	mg/kg wet							
Nickel	ND	1.0	mg/kg wet							
Zinc	ND	5.0	mg/kg wet							
LCS Analyzed: 10/31/01 (I1J3081-BS1)										
Chromium	49.8	1.0	mg/kg wet	50.0		100	80-120			
Copper	46.3	1.0	mg/kg wet	50.0		93	80-120			
Nickel	48.2	1.0	mg/kg wet	50.0		96	80-120			
Zinc	48.2	5.0	mg/kg wet	50.0		96	80-120			
Matrix Spike Analyzed: 10/31/01 (I1J3081-MS1)					**Source: IKJ1142-21**					
Chromium	55.3	1.0	mg/kg wet	50.0	9.1	92	75-125			
Copper	51.4	1.0	mg/kg wet	50.0	4.1	95	75-125			
Nickel	54.1	1.0	mg/kg wet	50.0	7.0	94	75-125			
Zinc	64.4	5.0	mg/kg wet	50.0	17	95	75-125			
Matrix Spike Dup Analyzed: 10/31/01 (I1J3081-MSD1)					**Source: IKJ1142-21**					
Chromium	55.2	1.0	mg/kg wet	50.0	9.1	92	75-125	0	20	
Copper	50.6	1.0	mg/kg wet	50.0	4.1	93	75-125	2	20	
Nickel	52.7	1.0	mg/kg wet	50.0	7.0	91	75-125	3	20	
Zinc	63.5	5.0	mg/kg wet	50.0	17	93	75-125	1	20	
Batch: I1J3140 Extracted: 10/31/01										
Blank Analyzed: 11/02/01 (I1J3140-BLK1)										
Chromium	ND	1.0	mg/kg wet							
Copper	ND	1.0	mg/kg wet							
Nickel	ND	1.0	mg/kg wet							
Zinc	ND	5.0	mg/kg wet							

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Project ID: 01204A Catalina NPDES

Report Number: IKJ1098

Sampled: 10/19/01
Received: 10/26/01

METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: I1J3140 Extracted: 10/31/01										
LCS Analyzed: 11/02/01 (I1J3140-BS1)										
Chromium	51.8	1.0	mg/kg wet	50.0		104	80-120			
Copper	49.5	1.0	mg/kg wet	50.0		99	80-120			
Nickel	49.8	1.0	mg/kg wet	50.0		100	80-120			
Zinc	49.3	5.0	mg/kg wet	50.0		99	80-120			
Matrix Spike Analyzed: 11/03/01 (I1J3140-MS1)					**Source: IKJ1156-01**					
Chromium	56.3	1.0	mg/kg wet	50.0	18	77	75-125			
Copper	60.0	1.0	mg/kg wet	50.0	21	78	75-125			
Nickel	50.6	1.0	mg/kg wet	50.0	13	75	75-125			
Zinc	104	5.0	mg/kg wet	50.0	68	72	75-125			*M2*
Matrix Spike Dup Analyzed: 11/03/01 (I1J3140-MSD1)					**Source: IKJ1156-01**					
Chromium	54.9	1.0	mg/kg wet	50.0	18	74	75-125	3	20	*M2*
Copper	58.4	1.0	mg/kg wet	50.0	21	75	75-125	3	20	
Nickel	49.6	1.0	mg/kg wet	50.0	13	73	75-125	2	20	*M2*
Zinc	101	5.0	mg/kg wet	50.0	68	66	75-125	3	20	*M2*

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Attention: Mike Curtis

Project ID: 01204A Catalina NPDES

Report Number: IKJ1098

Sampled: 10/19/01
Received: 10/26/01

METHOD BLANK/QC DATA

INORGANICS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: I1J2975 Extracted: 10/29/01										
Blank Analyzed: 10/29/01 (I1J2975-BLK1)										
Percent Solids	ND	0.010	%							
Duplicate Analyzed: 10/29/01 (I1J2975-DUP1)					**Source: IKJ0978-01RE1**					
Percent Solids	12.4	0.010	%		12			3	20	

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Project ID: 01204A Catalina NPDES

Report Number: IKJ1098

Sampled: 10/19/01
Received: 10/26/01

DATA QUALIFIERS AND DEFINITIONS

M2 The MS and/or MSD were below the acceptance limits due to sample matrix interference. See Blank Spike (LCS).

ND Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.

NR Not reported.

RPD Relative Percent Difference

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Attention: Mike Curtis

Project ID: 01214A Manhattan Pier NPDES

Report Number: IKJ0192

Sampled: 08/10/01
Received: 10/04/01

METALS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
			mg/kg dry	mg/kg dry				
Sample ID: IKJ0192-04 (MT MP-I - Soil)								
Chromium	EPA 6010B	I1J0951	5.2	ND	1	10/9/01	10/10/01	
Copper	EPA 6010B	I1J0951	5.2	ND	1	10/9/01	10/10/01	L2
Nickel	EPA 6010B	I1J0951	5.2	ND	1	10/9/01	10/10/01	
Zinc	EPA 6010B	I1J0951	26	**45**	1	10/9/01	10/10/01	
Sample ID: IKJ0192-05 (MT MP-II - Soil)								
Chromium	EPA 6010B	I1J0951	4.7	ND	1	10/9/01	10/10/01	
Copper	EPA 6010B	I1J0951	4.7	**5.3**	1	10/9/01	10/10/01	L2
Nickel	EPA 6010B	I1J0951	4.7	ND	1	10/9/01	10/10/01	
Zinc	EPA 6010B	I1J0951	23	**68**	1	10/9/01	10/10/01	
Sample ID: IKJ0192-06 (MT MP-III - Soil)								
Chromium	EPA 6010B	I1J0951	4.5	ND	1	10/9/01	10/10/01	
Copper	EPA 6010B	I1J0951	4.5	**5.7**	1	10/9/01	10/10/01	L2
Nickel	EPA 6010B	I1J0951	4.5	ND	1	10/9/01	10/10/01	
Zinc	EPA 6010B	I1J0951	23	**48**	1	10/9/01	10/10/01	

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Project ID: 01214A Manhattan Pier NPDES

Report Number: IKJ0192

Sampled: 08/10/01
Received: 10/04/01

INORGANICS

Analyte	Method	Batch	Reporting Limit	Sample Result	Dilution Factor	Date Extracted	Date Analyzed	Data Qualifiers
			%	%				
Sample ID: IKJ0192-04 (MT MP-I - Soil)								
Percent Solids	EPA 160.3 MOD	I1J0550	0.010	**19**	1	10/5/01	10/5/01	H3
Sample ID: IKJ0192-05 (MT MP-II - Soil)								
Percent Solids	EPA 160.3 MOD	I1J0550	0.010	**21**	1	10/5/01	10/5/01	H3
Sample ID: IKJ0192-06 (MT MP-III - Soil)								
Percent Solids	EPA 160.3 MOD	I1J0550	0.010	**22**	1	10/5/01	10/5/01	H3

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Attention: Mike Curtis

Project ID: 01214A Manhattan Pier NPDES

Report Number: IKJ0192

Sampled: 08/10/01
Received: 10/04/01

METHOD BLANK/QC DATA

METALS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: I1J0951 Extracted: 10/09/01										
Blank Analyzed: 10/10/01 (I1J0951-BLK1)										
Chromium	ND	1.0	mg/kg wet							
Copper	ND	1.0	mg/kg wet							
Nickel	ND	1.0	mg/kg wet							
Zinc	ND	5.0	mg/kg wet							
LCS Analyzed: 10/10/01 (I1J0951-BS1)										
Chromium	42.4	1.0	mg/kg wet	50.0		85	80-120			
Copper	39.7	1.0	mg/kg wet	50.0		79	80-120			L2
Nickel	41.4	1.0	mg/kg wet	50.0		83	80-120			
Zinc	40.6	5.0	mg/kg wet	50.0		81	80-120			
Matrix Spike Analyzed: 10/10/01 (I1J0951-MS1)					**Source: IKJ0257-02**					
Chromium	48.7	1.0	mg/kg wet	50.0	9.0	79	75-125			
Copper	46.6	1.0	mg/kg wet	50.0	6.5	80	75-125			L2
Nickel	45.8	1.0	mg/kg wet	50.0	6.4	79	75-125			
Zinc	64.8	5.0	mg/kg wet	50.0	29	72	75-125			M2
Matrix Spike Dup Analyzed: 10/10/01 (I1J0951-MSD1)					**Source: IKJ0257-02**					
Chromium	52.8	1.0	mg/kg wet	50.0	9.0	88	75-125	8	20	
Copper	51.0	1.0	mg/kg wet	50.0	6.5	89	75-125	9	20	L2
Nickel	49.7	1.0	mg/kg wet	50.0	6.4	87	75-125	8	20	
Zinc	69.9	5.0	mg/kg wet	50.0	29	82	75-125	8	20	

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Project ID: 01214A Manhattan Pier NPDES

Report Number: IKJ0192

Sampled: 08/10/01
Received: 10/04/01

METHOD BLANK/QC DATA

INORGANICS

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Data Qualifiers
Batch: I1J0550 Extracted: 10/05/01										
Blank Analyzed: 10/05/01 (I1J0550-BLK1)										
Percent Solids	ND	0.010	%							
Duplicate Analyzed: 10/05/01 (I1J0550-DUP1)					**Source: IKJ0128-01**					
Percent Solids	19.6	0.010	%		20			2	20	

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Attention: Mike Curtis

Project ID: 01214A Manhattan Pier NPDES

Report Number: IKJ0192

Sampled: 08/10/01
Received: 10/04/01

DATA QUALIFIERS AND DEFINITIONS

H3	Sample was received and analyzed past holding time.
L2	Laboratory Control Sample recovery was below method control limits. See Corrective Action Report.
M2	The MS and/or MSD were below the acceptance limits due to sample matrix interference. See Blank Spike (LCS).
ND	Analyte NOT DETECTED at or above the reporting limit or MDL, if MDL is specified.
NR	Not reported.
RPD	Relative Percent Difference

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Appendix F-1. Yearly bay mussel tissue metal concentrations (mg/dry kg), 1990 - 1993, 1999 - 2001. Reliant Energy Ormond Beach generating station NPDES, 2001.

	Chromium (ERL = 81)					Copper (ERL = 34)					Nickel (ERL = 21)					Zinc (ERL = 150)				
	Rep 1	Rep 2	Rep 3	Mean	S.D.	Rep 1	Rep 2	Rep 3	Mean	S.D.	Rep 1	Rep 2	Rep 3	Mean	S.D.	Rep 1	Rep 2	Rep 3	Mean	S.D.
2001	ND	ND	ND	-	-	8.7	7.0	8.3	8.0	0.9	ND	ND	ND	-	-	77	96	150	108	37.9
2000	ND	ND	ND	-	-	8.8	12	9.8	10.2	1.6	ND	ND	ND	-	-	90	120	96	102	15.9
1999	ND	ND	ND	-	-	5.5	12	17	11.5	5.8	ND	ND	ND	-	-	150	94	100	115	30.7
1993	ND	NS	NS	-	-	2.4	NS	NS	2.4	-	ND	NS	NS	-	-	13	NS	NS	13	-
1992	ND	NS	NS	-	-	3.4	NS	NS	3.4	-	ND	NS	NS	-	-	19	NS	NS	19	-
1991	65.0	NS	NS	65.0	-	55.0	NS	NS	55.0	-	28.5	NS	NS	28.5	-	26	NS	NS	26	-
1990	2.24	1.73	1.57	1.85	0.35	2.2	0.9	1.5	1.5	0.7	ND	ND	ND	-	-	81	73	57	70	12.2

ND = Below the detection limit (for calculations ND = 0)
NS = Not Sampled
ERL = Effects Range Low

APPENDIX G

Infauna data by station

Appendix G-1. Infaunal master species list. Reliant Energy Ormond Beach generating station NPDES, 2001.

PHYLUM
- Subphylum or Class
  - Species

CNIDARIA
- Anthozoa
  - Actiniaria
  - Limnactiniidae sp A SCAMIT 1989
  - *Renilla kollikeri*
  - *Zaolutus actius*

PLATYHELMINTHES
- Turbellaria
  - *Notoplana* sp
  - *Pseudoceros* sp
  - *Stylochoplana* sp[1]

NEMERTEA
- Anopla
  - *Carinoma mutabilis*
  - Lineidae
  - *Tubulanus polymorphus*[2]
- Enopla
  - *Cerebratulus* sp
  - *Paranemertes californica*[3]
  - *Tetrastemma nigrifrons*
  - *Zygonemertes virescens*
- Uncertain
  - Nemertea

NEMATODA
  - Nematoda

MOLLUSCA
- Bivalvia
  - *Cooperella subdiaphana*
  - *Ennucula tenuis*
  - *Leptopecten latiauratus*
  - *Macoma* sp
  - *Macoma yoldiformis*
  - *Mactromeris catilliformis*
  - *Modiolus* sp
  - *Pandora bilirata*
  - *Periploma planiusculum*
  - *Protothaca staminea*
  - *Rhamphidonta retifera*
  - *Rochefortia tumida*[4]
  - *Siliqua lucida*
  - *Simomactra planulata*
  - *Sphenia fragilis*
  - *Tellina bodegensis*
  - *Tellina modesta*
- Gastropoda
  - *Acteocina cucitella*[5]
  - *Balcis oldroydae*[6]
  - *Crepidula norrisiarum*
  - *Crepidula* sp
  - Facelinidae
  - *Nassarius perpinguis*
  - *Neverita reclusiana*
  - *Odostomia* sp D MBC 1980
  - *Olivella baetica*
  - *Rictaxis punctocaelatus*
- Scaphopoda
  - *Cadulus aberrans*[7]

SIPUNCULA
- Sipunculiformes
  - *Siphonosoma ingens*
  - Sipuncula

PHYLUM
- Subphylum or Class
  - Species

ANNELIDA
- Polychaeta
  - *Ampharete labrops*
  - *Ancistrosyllis hamata*
  - *Apoprionospio pygmaea*
  - *Arabella iricolor*
  - *Aricidea (Acmira) catherinae*[8]
  - *Armandia brevis*[9]
  - *Brania californiensis*
  - *Capitella capitata* Cmplx
  - *Carazziella* sp A SCAMIT 1995
  - *Caulleriella* sp
  - *Chaetzone corona*
  - *Chaetozone setosa* Cmplx[10]
  - Chone sp SD 1 Pt. Loma 1997
  - *Diopatra ornata*
  - *Diopatra splendidissima*
  - *Dipolydora socialis*[11]
  - *Dispio uncinata*
  - *Ephesiella brevicapitis*
  - *Eumida longicornuta*[12]
  - *Eupolymnia heterobranchia*
  - *Eusyllis* sp
  - *Exogone lourei*
  - *Glycera macrobranchia*[13]
  - *Glycera* sp
  - *Glycinde armigera*
  - *Goniada littorea*
  - *Harmothoe* sp
  - *Leitoscoloplos pugettensis*[14]
  - *Loimia* sp A SCAMIT 2001[15]
  - *Lumbrineris californiensis*
  - *Lumbrineris* sp
  - *Magelona pigmentata*
  - *Magelona pitelkai*
  - *Magelona sacculata*
  - Maldanidae
  - *Malmgreniella macginitiei*
  - *Mediomastus acutus*
  - *Mediomastus californiensis*[16]
  - *Monticellina cryptica*[17]
  - *Neosabellaria cementarium*
  - *Nephtys caecoides*
  - *Nephtys cornuta*[18]
  - Nereididae
  - *Nereis latescens*
  - *Notocirrus californiensis*
  - *Onuphis* sp 1 Pt. Loma 1983
  - *Ophiodromus pugettensis*
  - *Owenia collaris*[19]
  - *Paraprionospio pinnata*
  - *Pectinaria californiensis*
  - *Phyllodoce hartmanae*
  - *Phyllodoce longipes*
  - *Phyllodoce* sp
  - *Pista elongata*
  - *Platynereis bicanalicalata*
  - *Poecilochaetus johnsoni*
  - Polychaeta
  - *Polycirrus californicus*
  - *Polydora cirrosa*
  - *Polydora cornuta*
  - *Polydora limicola*
  - *Prionospio (Minuspio) lighti*[20]
  - *Scoletoma* sp
  - *Scoloplos armiger* Cmplx
  - *Sigalion spinosus*[21]
  - *Sphaerephesia similisetis*
  - *Spiochaetopterus costarum*
  - *Spiophanes berkeleyorum*

Appendix G-1. (Cont.).

PHYLUM / Subphylum or Class / Species	PHYLUM / Subphylum or Class / Species
ANNELIDA (Cont.).	ARTHROPODA (Cont.).
Polychaeta	Malacostraca
Spiophanes bombyx	*Neotrypaea californiensis*[35]
Spiophanes duplex[22]	*Photis brevipes*
Syllis (Typosyllis) farallonensis[23]	*Photis macinerneyi*
Syllis (Typosyllis) heterochaeta	*Rhepoxynius abronius*
Oligochaeta	*Rhepoxynius menziesi*[36]
Oligochaeta[24]	*Rhepoxynius* sp A SCAMIT 1987
	Rhepoxynius variatus
ARTHROPODA	*Tiron biocellata*
Cirripedia	*Uromunna ubiquita*[37]
Balanus pacificus	Ostracoda
Malacostraca	*Asteropella slatteryi*
Alpheus clamator	*Euphilomedes carcharodonta*
Americhelidium rectipalmum[25]	*Leuroleberis sharpei*
Americhelidium shoemakeri[26]	*Parasterope hulingsi*
Ampelisca agassizi[27]	*Rutiderma rostratum*
Anchicolurus occidentalis	*Zeugophilomedes oblongatus*
Aoroides inermis	Pycnogonida
Campylaspis sp C Myers & Benedict 1974	*Anoropallene palpida*
Cancer antennarius	
Cancer sp	ECHINODERMATA
Cerapus tubularis Cmplx	Echinoidea
Cumella californica[28]	*Dendraster excentricus*
Cyclaspis nubila	Holothuroidea
Cyclaspis sp C SCAMIT 1986	*Leptosynapta* sp[38]
Diastylopsis tenuis	Ophiuroidea
Edotia sublittoralis[29]	*Amphiodia psara*[39]
Ericthonius brasiliensis	*Amphiura arcystata*
Foxiphalus obtusidens	Amphiuridae
Gammaropsis thompsoni	
Gibberosus myersi[30]	BRACHIOPODA
Hartmanodes hartmanae[31]	Inarticulata
Ischyrocerus anguipes	*Glottidia albida*
Jassa slatteryi[32]	
Joeropsis dubia	PHORONA
Lamprops carinatus	Phoronida
Lamprops quadriplicatus	*Phoronis* sp
Lepidepecreum serraculum[33]	*Phoronopsis* sp
Listriella melanica	
Metamysidopsis elongata	CHORDATA
Monocorophium sp	Hemichordata
Nebalia daytoni[34]	Enteropneusta[40]

The following footnotes indicate names used in previous surveys:

1 *Platyhelminthes* sp D MBC
2 *Tubulanus pellucidus/polymorphus*, *T.* sp or *T.* spp
3 *Paranemertes* sp A of SCAMIT
4 *Mysella tumida*, *M. cf. aleutica*
5 *Cylichnella culcitella*
6 *Balcis oldroydi*
7 *Gadila aberrans*
8 *Acmira catherinae*
9 *Armandia bioculata*
10 *Chaetozone "setosa"*, *C.* cf. *setosa*
11 *Polydora socialis*
12 *Eumida* sp 2 Hamilton, E. sp B SCAMIT
13 *Glycera convoluta*
14 *Haploscoloplos elongatus*
15 *Loimia medusa*
16 *Mediomastus* spp in part
17 *Monticellina dorsobranchialis*, *Tharyx* sp A SCAMIT
18 *Nephtys cornuta franciscana*
19 *Owenia fusiformis*
20 *Minuspio cirrifera*, *Prionospio cirrifera*
21 *Thalenessa spinosum*
22 *Spiophanes missionenesis*
23 *Typosyllis farallonensis*
24 *Tubificoides gabriellae* or *T. apectinatus*
25 *Synchelidium rectipalmum*
26 *Synchelidium shoemakeri*
27 *Ampelisca compressa*
28 *Cumella* sp A Myers & Benedict or *C.* sp A MBC
29 *Edotea sublittoralis*
30 *Megaluropus longimerus*
31 *Monoculodes hartmanae*
32 *Jassa falcata*
33 *Lepidepecreum* sp A SCAMIT 1985
34 *Nebalia pugettensis* in part
35 *Callianassa* sp
36 *Paraphoxus epistomus*, *Rhepoxynius epistomus*
37 *Munna ubiquita*
38 *Leptosynapta* sp B Benedict or of MBC
39 includes *Amphiodia occidentalis*
40 Hemichordata

Appendix G-2. Infauna results by station. Reliant Energy Ormond Beach generating station NPDES, 2001.

		Station							Percent
Phylum	Species	B1	B2	B3	B4	B5	B6	Total	Total
AN	*Apoprionospio pygmaea*	58	21	27	28	20	794	948	28.63
EC	*Dendraster excentricus*	7	35	67	93	55	103	360	10.87
AN	*Armandia brevis*	90	3	85	4	-	142	324	9.79
AR	*Diastylopsis tenuis*	23	28	12	55	12	6	136	4.11
AN	*Owenia collaris*	25	38	25	14	3	6	111	3.35
MO	*Tellina modesta*	15	17	14	48	10	2	106	3.20
AN	*Mediomastus acutus*	25	10	20	18	21	-	94	2.84
AR	*Rhepoxynius abronius*	8	2	31	12	5	7	65	1.96
AR	*Aoroides inermis*	30	2	19	8	-	1	60	1.81
NE	*Carinoma mutabilis*	1	10	10	11	11	11	54	1.63
AR	*Rhepoxynius menziesi*	13	3	17	8	3	4	48	1.45
MO	*Rochefortia tumida*	1	3	8	12	20	1	45	1.36
AN	*Aricidea (Acmira) catherinae*	3	12	12	6	6	-	39	1.18
AR	*Lamprops carinatus*	-	3	4	5	-	27	39	1.18
AR	*Gibberosus myersi*	10	16	3	-	8	-	37	1.12
MO	*Mactromeris catilliformis*	3	8	4	12	6	2	35	1.06
AN	*Spiophanes bombyx*	4	7	7	7	6	2	33	1.00
AR	*Balanus pacificus*	5	-	16	10	-	-	31	0.94
AR	*Photis macinerneyi*	1	11	1	2	1	13	29	0.88
AN	*Onuphis* sp 1 Pt. Loma 1983	-	6	-	4	11	3	24	0.72
AN	*Spiochaetopterus costarum*	3	3	5	4	4	5	24	0.72
NE	*Tubulanus polymorphus*	1	6	-	5	7	4	23	0.69
AN	*Carazziella* sp A SCAMIT 1995	-	-	-	22	-	-	22	0.66
PR	*Phoronis* sp	3	5	4	2	6	1	21	0.63
CO	Enteropneusta	1	2	3	5	7	2	20	0.60
AN	*Pectinaria californiensis*	-	4	5	3	6	1	19	0.57
NE	*Paranemertes californica*	3	1	5	3	1	5	18	0.54
AR	*Photis brevipes*	12	-	1	1	-	-	14	0.42
AR	*Rhepoxynius* sp A SCAMIT 1987	-	-	1	-	-	13	14	0.42
MO	*Siliqua lucida*	1	3	1	4	1	4	14	0.42
AR	*Americhelidium shoemakeri*	4	1	1	1	1	5	13	0.39
AR	*Anchicolurus occidentalis*	3	5	-	5	-	-	13	0.39
NE	Lineidae	1	4	7	-	-	-	12	0.36
NE	*Zygonemertes virescens*	-	-	-	-	-	12	12	0.36
AN	*Magelona pitelkai*	1	1	1	3	2	3	11	0.33
AN	*Sigalion spinosus*	2	2	3	3	1	-	11	0.33
MO	*Cooperella subdiaphana*	1	2	1	5	1	-	10	0.30
AN	*Glycera macrobranchia*	2	4	2	1	1	-	10	0.30
AN	*Goniada littorea*	2	2	3	2	1	-	10	0.30
MO	*Macoma* sp	-	5	2	2	1	-	10	0.30
AR	*Uromunna ubiquita*	-	2	2	5	-	1	10	0.30
AR	*Cumella californica*	5	2	-	-	2	-	9	0.27
AN	*Polydora cornuta*	-	-	5	4	-	-	9	0.27
AN	*Prionospio (Minuspio) lighti*	-	-	9	-	-	-	9	0.27
AR	*Edotia sublittoralis*	-	1	-	2	4	1	8	0.24
AN	*Exogone lourei*	2	5	-	-	1	-	8	0.24
CN	Limnactiniidae sp A SCAMIT 1989	-	2	-	2	3	1	8	0.24
AN	*Magelona sacculata*	1	1	-	5	1	-	8	0.24
AN	*Dispio uncinata*	-	-	-	-	4	3	7	0.21
AR	*Foxiphalus obtusidens*	5	-	-	2	-	-	7	0.21
AR	*Ericthonius brasiliensis*	-	-	5	-	-	1	6	0.18
AN	*Mediomastus californiensis*	3	1	2	-	-	-	6	0.18
MO	*Modiolus* sp	-	-	4	2	-	-	6	0.18
MO	*Nassarius perpinguis*	1	-	-	-	-	5	6	0.18
NT	Nematoda	1	1	-	-	2	2	6	0.18
NE	Nemertea	1	2	1	-	2	-	6	0.18
AN	*Nephtys caecoides*	-	-	3	1	2	-	6	0.18
AN	*Phyllodoce hartmanae*	1	-	-	-	1	4	6	0.18
CN	Actiniaria	-	5	-	-	-	-	5	0.15
AR	*Anoropallene palpida*	-	2	-	-	3	-	5	0.15
AN	*Chaetozone setosa* Cmplx	-	2	1	-	2	-	5	0.15
AR	*Lamprops quadriplicatus*	-	-	-	3	1	1	5	0.15
AN	*Malmgreniella macginitiei*	2	-	2	-	1	-	5	0.15
AN	*Nereis latescens*	1	-	2	2	-	-	5	0.15
AN	*Phyllodoce longipes*	2	-	2	1	-	-	5	0.15

Appendix G-2. (Cont.).

Phylum	Species	Station B1	B2	B3	B4	B5	B6	Total	Percent Total
AN	*Spiophanes duplex*	1	-	1	1	2	-	5	0.15
AR	*Ampelisca agassizi*	-	3	-	-	1	-	4	0.12
AN	*Brania californiensis*	2	-	2	-	-	-	4	0.12
AR	*Campylaspis* sp C Myers & Benedict 1974	-	-	-	1	1	2	4	0.12
AN	*Capitella capitata* Cmplx	-	-	-	-	-	4	4	0.12
MO	*Crepidula* sp	2	-	2	-	-	-	4	0.12
AN	*Dipolydora socialis*	-	-	-	-	3	1	4	0.12
AR	*Jassa slatteryi*	-	-	-	1	1	2	4	0.12
EC	*Leptosynapta* sp	1	-	-	-	2	1	4	0.12
AN	*Monticellina cryptica*	1	-	-	1	2	-	4	0.12
AN	*Nephtys cornuta*	3	-	-	-	1	-	4	0.12
AN	*Paraprionospio pinnata*	1	-	1	1	1	-	4	0.12
PR	*Phoronopsis* sp	2	1	1	-	-	-	4	0.12
AR	*Rutiderma rostratum*	1	-	-	1	2	-	4	0.12
SI	*Siphonosoma ingens*	-	1	1	1	1	-	4	0.12
AN	*Syllis (Ehlersia) heterochaeta*	3	-	-	-	-	1	4	0.12
MO	*Acteocina cucitella*	-	-	2	1	-	-	3	0.09
AR	*Americhelidium rectipalmum*	1	-	2	-	-	-	3	0.09
AN	*Ampharete labrops*	3	-	-	-	-	-	3	0.09
AR	*Cerapus tubularis* Cmplx	3	-	-	-	-	-	3	0.09
AN	*Chone* sp SD 1 Pt. Loma 1997	2	-	-	1	-	-	3	0.09
AR	*Cyclaspis* sp C SCAMIT 1986	-	1	-	-	2	-	3	0.09
MO	*Ennucula tenuis*	-	1	-	1	1	-	3	0.09
AR	*Euphilomedes carcharodonta*	1	2	-	-	-	-	3	0.09
AN	*Eupolymnia heterobranchia*	-	-	-	3	-	-	3	0.09
AR	*Gammaropsis thompsoni*	1	-	2	-	-	-	3	0.09
AN	*Glycinde armigera*	-	-	-	1	2	-	3	0.09
AR	*Leuroleberis sharpei*	1	1	1	-	-	-	3	0.09
AN	Maldanidae	-	1	1	-	1	-	3	0.09
AR	*Metamysidopsis elongata*	-	-	-	-	-	3	3	0.09
MO	*Pandora bilirata*	1	2	-	-	-	-	3	0.09
MO	*Periploma planiusculum*	-	-	1	1	1	-	3	0.09
AN	*Pista elongata*	-	2	1	-	-	-	3	0.09
AN	*Polydora cirrosa*	1	-	2	-	-	-	3	0.09
AN	*Polydora limicola*	2	1	-	-	-	-	3	0.09
MO	*Protothaca staminea*	1	2	-	-	-	-	3	0.09
AN	*Scoloplos armiger* Cmplx	-	-	-	-	1	2	3	0.09
AN	*Sphaerephesia similisetis*	-	2	-	-	1	-	3	0.09
AR	*Tiron biocellata*	-	2	-	-	1	-	3	0.09
AR	*Zeugophilomedes oblongatus*	-	-	1	-	2	-	3	0.09
EC	*Amphiodia psara*	-	-	1	-	1	-	2	0.06
EC	*Amphiura arcystata*	-	-	-	1	1	-	2	0.06
AR	*Asteropella slatteryi*	-	2	-	-	-	-	2	0.06
AR	*Cancer antennarius*	-	-	2	-	-	-	2	0.06
AN	*Diopatra splendidissima*	1	-	1	-	-	-	2	0.06
AN	*Eumida longicornuta*	-	-	2	-	-	-	2	0.06
MO	Facelinidae	-	-	2	-	-	-	2	0.06
BC	*Glottidia albida*	2	-	-	-	-	-	2	0.06
AR	*Ischyrocerus anguipes*	-	-	1	1	-	-	2	0.06
AN	*Leitoscoloplos pugettensis*	-	1	1	-	-	-	2	0.06
AR	*Nebalia daytoni*	-	-	-	1	1	-	2	0.06
AN	*Neosabellaria cementarium*	-	-	2	-	-	-	2	0.06
MO	*Neverita reclusiana*	-	1	-	-	-	1	2	0.06
MO	*Olivella baetica*	-	1	-	-	-	1	2	0.06
AN	Polychaeta	2	-	-	-	-	-	2	0.06
CN	*Renilla kollikeri*	-	-	-	-	1	1	2	0.06
MO	*Rictaxis punctocaelatus*	-	1	-	1	-	-	2	0.06
AN	*Scoletoma* sp	-	1	1	-	-	-	2	0.06
AN	*Syllis (Typosyllis) farallonensis*	1	-	-	-	1	-	2	0.06
NE	*Tetrastemma nigrifrons*	1	-	1	-	-	-	2	0.06
AR	*Alpheus clamator*	-	-	-	1	-	-	1	0.03
EC	Amphiuridae	-	-	-	-	-	1	1	0.03
AN	*Ancistrosyllis hamata*	-	-	1	-	-	-	1	0.03
AN	*Arabella iricolor*	-	-	-	-	1	-	1	0.03
MO	*Balcis oldroydae*	-	-	-	-	1	-	1	0.03

Appendix G-2. (Cont.).

Phylum	Species	B1	B2	B3	B4	B5	B6	Total	Percent Total
		Station							
MO	*Cadulus aberrans*	-	-	-	1	-	-	1	0.03
AR	*Cancer* sp	-	-	-	1	-	-	1	0.03
AN	*Caulleriella* sp	1	-	-	-	-	-	1	0.03
NE	*Cerebratulus* sp	-	-	-	-	-	1	1	0.03
AN	*Chaetozone corona*	-	-	-	-	1	-	1	0.03
MO	*Crepidula norrisiarum*	-	1	-	-	-	-	1	0.03
AR	*Cyclaspis nubila*	-	-	1	-	-	-	1	0.03
AN	*Diopatra ornata*	1	-	-	-	-	-	1	0.03
AN	*Ephesiella brevicapitis*	-	-	1	-	-	-	1	0.03
AN	*Eusyllis* sp	1	-	-	-	-	-	1	0.03
AN	*Glycera* sp	-	-	-	-	1	-	1	0.03
AN	*Harmothoe* sp	-	-	1	-	-	-	1	0.03
AR	*Hartmanodes hartmanae*	-	1	-	-	-	-	1	0.03
AR	*Joeropsis dubia*	-	-	1	-	-	-	1	0.03
AR	*Lepidepecreum serraculum*	-	-	1	-	-	-	1	0.03
MO	*Leptopecten latiauratus*	1	-	-	-	-	-	1	0.03
AR	*Listriella melanica*	-	-	1	-	-	-	1	0.03
AN	*Loimia* sp A SCAMIT 2001	-	1	-	-	-	-	1	0.03
AN	*Lumbrineris californiensis*	-	-	-	-	1	-	1	0.03
AN	*Lumbrineris* spp	-	1	-	-	-	-	1	0.03
MO	*Macoma yoldiformis*	-	-	-	1	-	-	1	0.03
AN	*Megalomma pigmentum*	1	-	-	-	-	-	1	0.03
AR	*Monocorophium* sp	-	1	-	-	-	-	1	0.03
AR	*Neotrypaea californiensis*	-	-	1	-	-	-	1	0.03
AN	Nereididae	-	-	1	-	-	-	1	0.03
AN	*Notocirrus californiensis*	-	1	-	-	-	-	1	0.03
PL	*Notoplana* sp	-	-	1	-	-	-	1	0.03
MO	*Odostomia* sp D MBC 1980	-	1	-	-	-	-	1	0.03
AN	*Ophiodromus pugettensis*	-	-	-	-	-	1	1	0.03
AR	*Parasterope hulingsi*	-	-	-	1	-	-	1	0.03
AN	*Phyllodoce* sp	-	-	-	-	1	-	1	0.03
AN	*Platynereis bicanalicalata*	-	-	1	-	-	-	1	0.03
AN	*Poecilochaetus johnsoni*	-	-	-	-	1	-	1	0.03
AN	*Polycirrus californicus*	1	-	-	-	-	-	1	0.03
PL	*Pseudoceros* sp	1	-	-	-	-	-	1	0.03
MO	*Rhamphidonta retifera*	1	-	-	-	-	-	1	0.03
AR	*Rhepoxynius variatus*	-	-	1	-	-	-	1	0.03
MO	*Simomactra planulata*	-	-	-	-	1	-	1	0.03
SI	Sipuncula	-	1	-	-	-	-	1	0.03
MO	*Sphenia fragilis*	-	-	-	-	-	1	1	0.03
AN	*Spiophanes berkeleyorum*	-	-	1	-	-	-	1	0.03
PL	*Stylochoplana* sp	-	-	-	-	-	1	1	0.03
MO	*Tellina bodegensis*	-	-	-	-	-	1	1	0.03
CN	*Zaolutus actius*	-	1	-	-	-	-	1	0.03
	Number of individuals	436	349	513	481	309	1223	3311	
	Number of species	79	76	85	69	77	53	174	
	Diversity (H')	3.27	3.64	3.45	3.28	3.58	1.54	3.28	

Appendix G-3. Infauna data by station and replicate. Reliant Energy Ormond Beach generating station NPDES, 2001.

Station B1

Phylum	Species	Replicate B1-I	B1-II	B1-III	B1-IV	Total	Percent Composition	Density No./m²
AN	*Armandia brevis*	87	1	1	1	90	20.64	225.0
AN	*Apoprionospio pygmaea*	17	15	4	22	58	13.30	145.0
AR	*Aoroides inermis*	30	-	-	-	30	6.88	75.0
AN	*Mediomastus acutus*	18	7	-	-	25	5.73	62.5
AN	*Owenia collaris*	5	8	6	6	25	5.73	62.5
AR	*Diastylopsis tenuis*	7	9	6	1	23	5.28	57.5
MO	*Tellina modesta*	14	-	-	1	15	3.44	37.5
AR	*Rhepoxynius menziesi*	6	3	2	2	13	2.98	32.5
AR	*Photis brevipes*	12	-	-	-	12	2.75	30.0
AR	*Gibberosus myersi*	2	1	6	1	10	2.29	25.0
AR	*Rhepoxynius abronius*	6	1	1	-	8	1.83	20.0
EC	*Dendraster excentricus*	6	-	1	-	7	1.61	17.5
AR	*Balanus pacificus*	5	-	-	-	5	1.15	12.5
AR	*Cumella californica*	5	-	-	-	5	1.15	12.5
AR	*Foxiphalus obtusidens*	5	-	-	-	5	1.15	12.5
AR	*Americhelidium shoemakeri*	1	2	-	1	4	0.92	10.0
AN	*Spiophanes bombyx*	2	-	1	1	4	0.92	10.0
AN	*Ampharete labrops*	3	-	-	-	3	0.69	7.5
AR	*Anchicolurus occidentalis*	-	2	1	-	3	0.69	7.5
AN	*Aricidea (Acmira) catherinae*	1	-	-	2	3	0.69	7.5
AR	*Cerapus tubularis* Cmplx	3	-	-	-	3	0.69	7.5
MO	*Mactromeris catilliformis*	3	-	-	-	3	0.69	7.5
AN	*Mediomastus californiensis*	2	-	-	1	3	0.69	7.5
AN	*Nephtys cornuta*	1	-	-	2	3	0.69	7.5
NE	*Paranemertes californica*	3	-	-	-	3	0.69	7.5
PR	*Phoronis* sp	2	-	-	1	3	0.69	7.5
AN	*Spiochaetopterus costarum*	-	2	1	-	3	0.69	7.5
AN	*Syllis (Ehlersia) heterochaeta*	3	-	-	-	3	0.69	7.5
AN	*Brania californiensis*	2	-	-	-	2	0.46	5.0
AN	*Chone* sp SD 1 Pt. Loma 1997	-	-	1	1	2	0.46	5.0
MO	*Crepidula* sp	2	-	-	-	2	0.46	5.0
AN	*Exogone lourei*	1	-	-	1	2	0.46	5.0
BC	*Glottidia albida*	-	1	1	-	2	0.46	5.0
AN	*Glycera macrobranchia*	1	-	1	-	2	0.46	5.0
AN	*Goniada littorea*	-	1	-	1	2	0.46	5.0
AN	*Malmgreniella macginitiei*	-	1	-	1	2	0.46	5.0
PR	*Phoronopsis* sp	-	1	1	-	2	0.46	5.0
AN	*Phyllodoce longipes*	2	-	-	-	2	0.46	5.0
AN	*Polychaeta*	1	1	-	-	2	0.46	5.0
AN	*Polydora limicola*	2	-	-	-	2	0.46	5.0
AN	*Sigalion spinosus*	-	-	-	2	2	0.46	5.0
AR	*Americhelidium rectipalmum*	1	-	-	-	1	0.23	2.5
NE	*Carinoma mutabilis*	1	-	-	-	1	0.23	2.5
AN	*Caulleriella* sp	1	-	-	-	1	0.23	2.5
MO	*Cooperella subdiaphana*	-	-	1	-	1	0.23	2.5
AN	*Diopatra ornata*	1	-	-	-	1	0.23	2.5
AN	*Diopatra splendidissima*	1	-	-	-	1	0.23	2.5
CO	Enteropneusta	1	-	-	-	1	0.23	2.5
AR	*Euphilomedes carcharodonta*	-	-	-	1	1	0.23	2.5
AN	*Eusyllis* sp	1	-	-	-	1	0.23	2.5
AR	*Gammaropsis thompsoni*	1	-	-	-	1	0.23	2.5
MO	*Leptopecten latiauratus*	1	-	-	-	1	0.23	2.5
EC	*Leptosynapta* sp	-	-	-	1	1	0.23	2.5
AR	*Leuroleberis sharpei*	1	-	-	-	1	0.23	2.5
NE	Lineidae	-	1	-	-	1	0.23	2.5
AN	*Megalomma pigmentum*	1	-	-	-	1	0.23	2.5
AN	*Magelona pitelkai*	-	1	-	-	1	0.23	2.5
AN	*Magelona sacculata*	-	-	-	1	1	0.23	2.5
AN	*Monticellina cryptica*	1	-	-	-	1	0.23	2.5
MO	*Nassarius perpinguis*	-	-	1	-	1	0.23	2.5
NT	Nematoda	1	-	-	-	1	0.23	2.5
NE	Nemertea	-	-	1	-	1	0.23	2.5
AN	*Nereis latescens*	1	-	-	-	1	0.23	2.5
MO	*Pandora bilirata*	-	-	1	-	1	0.23	2.5
AN	*Paraprionospio pinnata*	1	-	-	-	1	0.23	2.5
AR	*Photis macinerneyi*	-	-	1	-	1	0.23	2.5
AN	*Phyllodoce hartmanae*	-	-	1	-	1	0.23	2.5
AN	*Polycirrus californicus*	-	1	-	-	1	0.23	2.5
AN	*Polydora cirrosa*	1	-	-	-	1	0.23	2.5

Appendix G-3. (Cont.).

Station B1

Phylum	Species	Replicate B1-I	B1-II	B1-III	B1-IV	Total	Percent Composition	Density No./m²
MO	*Protothaca staminea*	-	-	1	-	1	0.23	2.5
PL	*Pseudoceros* sp	1	-	-	-	1	0.23	2.5
MO	*Rhamphidonta retifera*	1	-	-	-	1	0.23	2.5
MO	*Rochefortia tumida*	-	1	-	-	1	0.23	2.5
AR	*Rutiderma rostratum*	1	-	-	-	1	0.23	2.5
MO	*Siliqua lucida*	-	-	1	-	1	0.23	2.5
AN	*Spiophanes duplex*	1	-	-	-	1	0.23	2.5
AN	*Syllis (Typosyllis) farallonensis*	-	-	-	1	1	0.23	2.5
NE	*Tetrastemma nigrifrons*	1	-	-	-	1	0.23	2.5
NE	*Tubulanus polymorphus*	-	1	-	-	1	0.23	2.5

Summary

Parameter	Replicate B1-I	B1-II	B1-III	B1-IV	Station Total	Overall Mean	S.D.
Number of individuals	281	61	42	52	436	109.0	114.9
Number of species	54	21	23	22	79	30.0	16.0
Diversity (H')	2.92	2.50	2.80	2.33	3.27	2.64	0.27

Appendix G-3. (Cont.).

Station B2

Phylum	Species	Replicate B2-I	B2-II	B2-III	B2-IV	Total	Percent Composition	Density No./m²
AN	*Owenia collaris*	8	13	14	3	38	10.89	95.0
EC	*Dendraster excentricus*	1	16	17	1	35	10.03	87.5
AR	*Diastylopsis tenuis*	3	14	3	8	28	8.02	70.0
AN	*Apoprionospio pygmaea*	2	7	10	2	21	6.02	52.5
MO	*Tellina modesta*	-	-	17	-	17	4.87	42.5
AR	*Gibberosus myersi*	2	2	4	8	16	4.58	40.0
AN	*Aricidea (Acmira) catherinae*	3	5	3	1	12	3.44	30.0
AR	*Photis macinerneyi*	2	5	1	3	11	3.15	27.5
NE	*Carinoma mutabilis*	5	3	-	2	10	2.87	25.0
AN	*Mediomastus acutus*	4	1	5	-	10	2.87	25.0
MO	*Mactromeris catilliformis*	1	4	1	2	8	2.29	20.0
AN	*Spiophanes bombyx*	1	2	4	-	7	2.01	17.5
AN	*Onuphis* sp 1 Pt. Loma 1983	2	-	2	2	6	1.72	15.0
NE	*Tubulanus polymorphus*	1	3	-	2	6	1.72	15.0
CN	Actiniaria	-	1	4	-	5	1.43	12.5
AR	*Anchicolurus occidentalis*	3	1	-	1	5	1.43	12.5
AN	*Exogone lourei*	1	-	4	-	5	1.43	12.5
MO	*Macoma* sp	-	-	5	-	5	1.43	12.5
PR	*Phoronis* sp	-	2	1	2	5	1.43	12.5
AN	*Glycera macrobranchia*	-	2	1	1	4	1.15	10.0
NE	Lineidae	-	3	-	1	4	1.15	10.0
AN	*Pectinaria californiensis*	1	-	3	-	4	1.15	10.0
AR	*Ampelisca agassizi*	1	-	-	2	3	0.86	7.5
AN	*Armandia brevis*	-	-	3	-	3	0.86	7.5
AR	*Lamprops carinatus*	-	-	1	2	3	0.86	7.5
AR	*Rhepoxynius menziesi*	1	-	2	-	3	0.86	7.5
MO	*Rochefortia tumida*	-	-	3	-	3	0.86	7.5
MO	*Siliqua lucida*	-	1	1	1	3	0.86	7.5
AN	*Spiochaetopterus costarum*	-	1	1	1	3	0.86	7.5
AR	*Anoropallene palpida*	-	-	2	-	2	0.57	5.0
AR	*Aoroides inermis*	-	-	2	-	2	0.57	5.0
AR	*Asteropella slatteryi*	-	-	2	-	2	0.57	5.0
AN	*Chaetozone setosa* Cmplx	-	1	-	1	2	0.57	5.0
MO	*Cooperella subdiaphana*	-	-	2	-	2	0.57	5.0
AR	*Cumella californica*	-	-	2	-	2	0.57	5.0
CO	Enteropneusta	1	-	1	-	2	0.57	5.0
AR	*Euphilomedes carcharodonta*	-	-	2	-	2	0.57	5.0
AN	*Goniada littorea*	2	-	-	-	2	0.57	5.0
CN	Limnactiniidae sp A SCAMIT 1989	1	-	-	1	2	0.57	5.0
NE	Nemertea	-	1	1	-	2	0.57	5.0
MO	*Pandora bilirata*	-	1	1	-	2	0.57	5.0
AN	*Pista elongata*	1	-	1	-	2	0.57	5.0
MO	*Protothaca staminea*	-	1	-	1	2	0.57	5.0
AR	*Rhepoxynius abronius*	-	-	2	-	2	0.57	5.0
AN	*Sigalion spinosus*	1	-	1	-	2	0.57	5.0
AN	*Sphaerephesia similisetis*	-	1	-	1	2	0.57	5.0
AR	*Tiron biocellata*	1	-	1	-	2	0.57	5.0
AR	*Uromunna ubiquita*	-	2	-	-	2	0.57	5.0
AR	*Americhelidium shoemakeri*	-	-	1	-	1	0.29	2.5
MO	*Crepidula norrisiarum*	-	-	1	-	1	0.29	2.5
AR	*Cyclaspis* sp C SCAMIT 1986	-	-	-	1	1	0.29	2.5
AR	*Edotia sublittoralis*	-	-	-	1	1	0.29	2.5
MO	*Ennucula tenuis*	-	-	1	-	1	0.29	2.5
AR	*Hartmanodes hartmanae*	-	-	1	-	1	0.29	2.5
AN	*Leitoscoloplos pugettensis*	-	-	1	-	1	0.29	2.5
AR	*Leuroleberis sharpei*	1	-	-	-	1	0.29	2.5
AN	*Loimia* sp A SCAMIT 2001	-	-	1	-	1	0.29	2.5
AN	*Lumbrineris* sp	1	-	-	-	1	0.29	2.5
AN	*Magelona pitelkai*	-	-	1	-	1	0.29	2.5
AN	*Magelona sacculata*	-	1	-	-	1	0.29	2.5
AN	Maldanidae	1	-	-	-	1	0.29	2.5
AN	*Mediomastus californiensis*	-	1	-	-	1	0.29	2.5
AR	*Monocorophium* sp	-	-	1	-	1	0.29	2.5
NT	Nematoda	-	-	1	-	1	0.29	2.5
MO	*Neverita reclusiana*	-	1	-	-	1	0.29	2.5
AN	*Notocirrus californiensis*	-	1	-	-	1	0.29	2.5
MO	*Odostomia* sp D MBC 1980	-	-	-	1	1	0.29	2.5
MO	*Olivella baetica*	-	1	-	-	1	0.29	2.5
NE	*Paranemertes californica*	1	-	-	-	1	0.29	2.5
PR	*Phoronopsis* sp	-	-	-	1	1	0.29	2.5

Appendix G-3. (Cont.).

Station B2

Phylum	Species	Replicate B2-I	B2-II	B2-III	B2-IV	Total	Percent Composition	Density No./m²
AN	*Polydora limicola*	-	-	1	-	1	0.29	2.5
MO	*Rictaxis punctocaelatus*	-	-	1	-	1	0.29	2.5
AN	*Scoletoma* sp	-	1	-	-	1	0.29	2.5
SI	*Siphonosoma ingens*	-	1	-	-	1	0.29	2.5
SI	Sipuncula	-	-	1	-	1	0.29	2.5
CN	*Zaolutus actius*	1	-	-	-	1	0.29	2.5

Summary

Parameter	Replicate B2-I	B2-II	B2-III	B2-IV	Station Total	Overall Mean	S.D.
Number of individuals	54	100	142	53	349	87.3	42.6
Number of species	29	32	49	27	76	34.3	10.0
Diversity (H')	3.12	2.94	3.38	3.01	3.64	3.11	0.19

Appendix G-3. (Cont.).

Station B3

Phylum	Species	Replicate B3-I	B3-II	B3-III	B3-IV	Total	Percent Composition	Density No./m²
AN	*Armandia brevis*	46	8	27	4	85	16.57	212.5
EC	*Dendraster excentricus*	12	18	5	32	67	13.06	167.5
AR	*Rhepoxynius abronius*	4	12	9	6	31	6.04	77.5
AN	*Apoprionospio pygmaea*	6	7	12	2	27	5.26	67.5
AN	*Owenia collaris*	1	3	5	16	25	4.87	62.5
AN	*Mediomastus acutus*	3	8	6	3	20	3.90	50.0
AR	*Aoroides inermis*	9	-	9	1	19	3.70	47.5
AR	*Rhepoxynius menziesi*	4	7	4	2	17	3.31	42.5
AR	*Balanus pacificus*	-	-	16	-	16	3.12	40.0
MO	*Tellina modesta*	-	5	7	2	14	2.73	35.0
AN	*Aricidea (Acmira) catherinae*	6	5	-	1	12	2.34	30.0
AR	*Diastylopsis tenuis*	1	2	2	7	12	2.34	30.0
NE	*Carinoma mutabilis*	4	-	2	4	10	1.95	25.0
AN	*Prionospio (Minuspio) lighti*	-	9	-	-	9	1.75	22.5
MO	*Rochefortia tumida*	-	7	1	-	8	1.56	20.0
NE	Lineidae	3	-	4	-	7	1.36	17.5
AN	*Spiophanes bombyx*	2	-	2	3	7	1.36	17.5
AR	*Ericthonius brasiliensis*	5	-	-	-	5	0.97	12.5
NE	*Paranemertes californica*	2	1	-	2	5	0.97	12.5
AN	*Pectinaria californiensis*	1	1	1	2	5	0.97	12.5
AN	*Polydora cornuta*	-	-	5	-	5	0.97	12.5
AN	*Spiochaetopterus costarum*	2	1	2	-	5	0.97	12.5
AR	*Lamprops carinatus*	-	-	4	-	4	0.78	10.0
MO	*Mactromeris catilliformis*	-	2	-	2	4	0.78	10.0
MO	*Modiolus* sp	3	-	1	-	4	0.78	10.0
PR	*Phoronis* sp	1	-	1	2	4	0.78	10.0
CO	Enteropneusta	1	-	2	-	3	0.58	7.5
AR	*Gibberosus myersi*	-	2	-	1	3	0.58	7.5
AN	*Goniada littorea*	-	1	1	1	3	0.58	7.5
AN	*Nephtys caecoides*	1	-	-	2	3	0.58	7.5
AN	*Sigalion spinosus*	-	-	1	2	3	0.58	7.5
MO	*Acteocina cucitella*	-	2	-	-	2	0.39	5.0
AR	*Americhelidium rectipalmum*	-	-	2	-	2	0.39	5.0
AN	*Brania californiensis*	2	-	-	-	2	0.39	5.0
AR	*Cancer antennarius*	1	-	1	-	2	0.39	5.0
MO	*Crepidula* sp	1	-	1	-	2	0.39	5.0
AN	*Eumida longicornuta*	-	-	2	-	2	0.39	5.0
MO	Facelinidae	1	-	1	-	2	0.39	5.0
AR	*Gammaropsis thompsoni*	1	-	1	-	2	0.39	5.0
AN	*Glycera macrobranchia*	1	-	1	-	2	0.39	5.0
MO	*Macoma* sp	-	1	1	-	2	0.39	5.0
AN	*Malmgreniella macginitiei*	-	1	1	-	2	0.39	5.0
AN	*Mediomastus californiensis*	1	1	-	-	2	0.39	5.0
AN	*Neosabellaria cementarium*	1	-	1	-	2	0.39	5.0
AN	*Nereis latescens*	2	-	-	-	2	0.39	5.0
AN	*Phyllodoce longipes*	-	-	2	-	2	0.39	5.0
AN	*Polydora cirrosa*	-	-	2	-	2	0.39	5.0
AR	*Uromunna ubiquita*	1	-	1	-	2	0.39	5.0
AR	*Americhelidium shoemakeri*	-	-	-	1	1	0.19	2.5
EC	*Amphiodia psara*	-	1	-	-	1	0.19	2.5
AN	*Ancistrosyllis hamata*	-	-	-	1	1	0.19	2.5
AN	*Chaetozone setosa* Cmplx	1	-	-	-	1	0.19	2.5
MO	*Cooperella subdiaphana*	-	-	-	1	1	0.19	2.5
AR	*Cyclaspis nubila*	-	-	-	1	1	0.19	2.5
AN	*Diopatra splendidissima*	-	-	1	-	1	0.19	2.5
AN	*Ephesiella brevicapitis*	-	1	-	-	1	0.19	2.5
AN	*Harmothoe* sp	1	-	-	-	1	0.19	2.5
AR	*Ischyrocerus anguipes*	1	-	-	-	1	0.19	2.5
AR	*Joeropsis dubia*	-	-	1	-	1	0.19	2.5
AN	*Leitoscoloplos pugettensis*	-	-	1	-	1	0.19	2.5
AR	*Lepidepecreum serraculum*	-	1	-	-	1	0.19	2.5
AR	*Leuroleberis sharpei*	-	-	1	-	1	0.19	2.5
AR	*Listriella melanica*	-	1	-	-	1	0.19	2.5
AN	*Magelona pitelkai*	-	-	-	1	1	0.19	2.5
AN	Maldanidae	-	1	-	-	1	0.19	2.5
NE	Nemertea	-	-	-	1	1	0.19	2.5
AR	*Neotrypaea californiensis*	-	1	-	-	1	0.19	2.5
AN	Nereididae	-	-	1	-	1	0.19	2.5
PL	*Notoplana* sp	-	-	1	-	1	0.19	2.5
AN	*Paraprionospio pinnata*	-	1	-	-	1	0.19	2.5

Appendix G-3. (Cont.).

Station B3

Phylum	Species	Replicate B3-I	B3-II	B3-III	B3-IV	Total	Percent Composition	Density No./m²
MO	*Periploma planisculum*	-	1	-	-	1	0.19	2.5
PR	*Phoronopsis* sp	1	-	-	-	1	0.19	2.5
AR	*Photis brevipes*	1	-	-	-	1	0.19	2.5
AR	*Photis macinerneyi*	-	1	-	-	1	0.19	2.5
AN	*Pista elongata*	1	-	-	-	1	0.19	2.5
AN	*Platynereis bicanalicalata*	-	-	1	-	1	0.19	2.5
AR	*Rhepoxynius* sp A SCAMIT 1987	1	-	-	-	1	0.19	2.5
AR	*Rhepoxynius variatus*	-	-	1	-	1	0.19	2.5
AN	*Scoletoma* sp	1	-	-	-	1	0.19	2.5
MO	*Siliqua lucida*	-	1	-	-	1	0.19	2.5
SI	*Siphonosoma ingens*	1	-	-	-	1	0.19	2.5
AN	*Spiophanes berkeleyorum*	-	-	-	1	1	0.19	2.5
AN	*Spiophanes duplex*	-	-	1	-	1	0.19	2.5
NE	*Tetrastemma nigrifrons*	1	-	-	-	1	0.19	2.5
AR	*Zeugophilomedes oblongatus*	-	1	-	-	1	0.19	2.5

Summary

Parameter	Replicate B3-I	B3-II	B3-III	B3-IV	Station Total	Overall Mean	S.D.
Number of individuals	139	115	155	104	513	128.3	23.1
Number of species	41	33	46	28	85	37.0	8.0
Diversity (H')	2.86	3.00	3.23	2.63	3.45	2.93	0.25

Appendix G-3. (Cont.).

Station B4

Phylum	Species	Replicate B4-I	B4-II	B4-III	B4-IV	Total	Percent Composition	Density No./m²
EC	*Dendraster excentricus*	28	2	20	43	93	19.33	232.5
AR	*Diastylopsis tenuis*	-	1	49	5	55	11.43	137.5
MO	*Tellina modesta*	4	6	30	8	48	9.98	120.0
AN	*Apoprionospio pygmaea*	9	10	6	3	28	5.82	70.0
AN	*Carazziella* sp A SCAMIT 1995	-	-	22	-	22	4.57	55.0
AN	*Mediomastus acutus*	9	-	4	5	18	3.74	45.0
AN	*Owenia collaris*	6	1	2	5	14	2.91	35.0
MO	*Mactromeris catilliformis*	4	1	2	5	12	2.49	30.0
AR	*Rhepoxynius abronius*	1	2	8	1	12	2.49	30.0
MO	*Rochefortia tumida*	4	-	4	4	12	2.49	30.0
NE	*Carinoma mutabilis*	3	3	2	3	11	2.29	27.5
AR	*Balanus pacificus*	-	-	10	-	10	2.08	25.0
AR	*Aoroides inermis*	-	-	8	-	8	1.66	20.0
AR	*Rhepoxynius menziesi*	1	-	4	3	8	1.66	20.0
AN	*Spiophanes bombyx*	1	1	1	4	7	1.46	17.5
AN	*Aricidea (Acmira) catherinae*	2	2	1	1	6	1.25	15.0
AR	*Anchicolurus occidentalis*	1	-	2	2	5	1.04	12.5
MO	*Cooperella subdiaphana*	3	1	1	-	5	1.04	12.5
CO	Enteropneusta	3	1	1	-	5	1.04	12.5
AR	*Lamprops carinatus*	1	-	3	1	5	1.04	12.5
AN	*Magelona sacculata*	-	2	-	3	5	1.04	12.5
NE	*Tubulanus polymorphus*	-	1	-	4	5	1.04	12.5
AR	*Uromunna ubiquita*	1	-	4	-	5	1.04	12.5
AN	*Armandia brevis*	-	1	3	-	4	0.83	10.0
AN	*Onuphis* sp 1 Pt. Loma 1983	1	-	2	1	4	0.83	10.0
AN	*Polydora cornuta*	-	-	4	-	4	0.83	10.0
MO	*Siliqua lucida*	-	1	2	1	4	0.83	10.0
AN	*Spiochaetopterus costarum*	1	1	-	2	4	0.83	10.0
AN	*Eupolymnia heterobranchia*	-	-	3	-	3	0.62	7.5
AR	*Lamprops quadriplicatus*	-	-	-	3	3	0.62	7.5
AN	*Magelona pitelkai*	2	-	1	-	3	0.62	7.5
NE	*Paranemertes californica*	-	2	1	-	3	0.62	7.5
AN	*Pectinaria californiensis*	-	2	-	1	3	0.62	7.5
AN	*Sigalion spinosus*	1	-	-	2	3	0.62	7.5
AR	*Edotia sublittoralis*	-	-	1	1	2	0.42	5.0
AR	*Foxiphalus obtusidens*	-	-	2	-	2	0.42	5.0
AN	*Goniada littorea*	-	1	1	-	2	0.42	5.0
CN	Limnactiniidae sp A SCAMIT 1989	-	1	-	1	2	0.42	5.0
MO	*Macoma* sp	-	2	-	-	2	0.42	5.0
MO	*Modiolus* sp	-	-	2	-	2	0.42	5.0
AN	*Nereis latescens*	-	-	2	-	2	0.42	5.0
PR	*Phoronis* sp	1	-	-	1	2	0.42	5.0
AR	*Photis macinerneyi*	-	-	1	1	2	0.42	5.0
MO	*Acteocina cucitella*	-	-	1	-	1	0.21	2.5
AR	*Alpheus clamator*	-	-	1	-	1	0.21	2.5
AR	*Americhelidium shoemakeri*	-	-	-	1	1	0.21	2.5
EC	*Amphiura arcystata*	1	-	-	-	1	0.21	2.5
MO	*Cadulus aberrans*	-	-	-	1	1	0.21	2.5
AR	*Campylaspis* sp C Myers & Benedict 1974	-	-	1	-	1	0.21	2.5
AR	*Cancer* sp	-	-	1	-	1	0.21	2.5
AN	*Chone* sp SD 1 Pt. Loma 1997	-	1	-	-	1	0.21	2.5
MO	*Ennucula tenuis*	-	-	-	1	1	0.21	2.5
AN	*Glycera macrobranchia*	-	-	-	1	1	0.21	2.5
AN	*Glycinde armigera*	-	-	1	-	1	0.21	2.5
AR	*Ischyrocerus anguipes*	-	-	1	-	1	0.21	2.5
AR	*Jassa slatteryi*	-	-	1	-	1	0.21	2.5
MO	*Macoma yoldiformis*	-	-	-	1	1	0.21	2.5
AN	*Monticellina cryptica*	-	-	-	1	1	0.21	2.5
AR	*Nebalia daytoni*	1	-	-	-	1	0.21	2.5
AN	*Nephtys caecoides*	-	-	-	1	1	0.21	2.5
AN	*Paraprionospio pinnata*	1	-	-	-	1	0.21	2.5
AR	*Parasterope hulingsi*	-	-	-	1	1	0.21	2.5
MO	*Periploma planiusculum*	-	-	1	-	1	0.21	2.5
AR	*Photis brevipes*	-	-	1	-	1	0.21	2.5
AN	*Phyllodoce longipes*	-	-	1	-	1	0.21	2.5
MO	*Rictaxis punctocaelatus*	1	-	-	-	1	0.21	2.5
AR	*Rutiderma rostratum*	1	-	-	-	1	0.21	2.5
SI	*Siphonosoma ingens*	-	-	1	-	1	0.21	2.5
AN	*Spiophanes duplex*	-	1	-	-	1	0.21	2.5

Appendix G-3. (Cont.).

Station B4

Summary

	Replicate				Station	Overall	
Parameter	B4-I	B4-II	B4-III	B4-IV	Total	Mean	S.D.
Number of individuals	92	47	220	122	481	120.3	73.3
Number of species	27	24	45	35	69	32.8	9.4
Diversity (H')	2.64	2.85	2.95	2.77	3.28	2.80	0.13

Appendix G-3. (Cont.).

Station B5

Phylum	Species	B5-I	B5-II	B5-III	B5-IV	Total	Percent Composition	Density No./m²
		Replicate						
EC	*Dendraster excentricus*	9	6	12	28	55	17.80	137.5
AN	*Mediomastus acutus*	5	8	4	4	21	6.80	52.5
AN	*Apoprionospio pygmaea*	4	5	2	9	20	6.47	50.0
MO	*Rochefortia tumida*	-	-	10	10	20	6.47	50.0
AR	*Diastylopsis tenuis*	1	2	6	3	12	3.88	30.0
NE	*Carinoma mutabilis*	2	3	6	-	11	3.56	27.5
AN	*Onuphis* sp 1 Pt. Loma 1983	2	4	2	3	11	3.56	27.5
MO	*Tellina modesta*	2	-	5	3	10	3.24	25.0
AR	*Gibberosus myersi*	5	-	2	1	8	2.59	20.0
CO	Enteropneusta	-	4	2	1	7	2.27	17.5
NE	*Tubulanus polymorphus*	1	-	5	1	7	2.27	17.5
AN	*Aricidea (Acmira) catherinae*	-	2	1	3	6	1.94	15.0
MO	*Mactromeris catilliformis*	1	-	3	2	6	1.94	15.0
AN	*Pectinaria californiensis*	1	-	3	2	6	1.94	15.0
PR	*Phoronis* sp	3	1	1	1	6	1.94	15.0
AN	*Spiophanes bombyx*	-	1	3	2	6	1.94	15.0
AR	*Rhepoxynius abronius*	-	1	1	3	5	1.62	12.5
AN	*Dispio uncinata*	4	-	-	-	4	1.29	10.0
AR	*Edotia sublittoralis*	3	-	-	1	4	1.29	10.0
AN	*Spiochaetopterus costarum*	2	2	-	-	4	1.29	10.0
AR	*Anoropallene palpida*	2	-	-	1	3	0.97	7.5
AN	*Dipolydora socialis*	-	1	-	2	3	0.97	7.5
CN	*Limnactiniidae* sp A SCAMIT 1989	1	-	-	2	3	0.97	7.5
AN	*Owenia collaris*	-	-	1	2	3	0.97	7.5
AR	*Rhepoxynius menziesi*	-	-	1	2	3	0.97	7.5
AN	*Chaetozone setosa* Cmplx	-	1	-	1	2	0.65	5.0
AR	*Cumella californica*	-	-	-	2	2	0.65	5.0
AR	*Cyclaspis* sp C SCAMIT 1986	-	-	1	1	2	0.65	5.0
AN	*Glycinde armigera*	1	1	-	-	2	0.65	5.0
EC	*Leptosynapta* sp	-	1	1	-	2	0.65	5.0
AN	*Magelona pitelkai*	1	-	1	-	2	0.65	5.0
AN	*Monticellina cryptica*	2	-	-	-	2	0.65	5.0
NT	Nematoda	1	-	1	-	2	0.65	5.0
NE	Nemertea	2	-	-	-	2	0.65	5.0
AN	*Nephtys caecoides*	1	-	-	1	2	0.65	5.0
AR	*Rutiderma rostratum*	1	-	1	-	2	0.65	5.0
AN	*Spiophanes duplex*	1	1	-	-	2	0.65	5.0
AR	*Zeugophilomedes oblongatus*	-	1	-	1	2	0.65	5.0
AR	*Americhelidium shoemakeri*	1	-	-	-	1	0.32	2.5
AR	*Ampelisca agassizi*	-	-	1	-	1	0.32	2.5
EC	*Amphiodia psara*	-	-	1	-	1	0.32	2.5
EC	*Amphiura arcystata*	-	-	-	1	1	0.32	2.5
AN	*Arabella iricolor*	-	-	1	-	1	0.32	2.5
MO	*Balcis oldroydae*	-	1	-	-	1	0.32	2.5
AR	*Campylaspis* sp C Myers & Benedict 1974	-	-	1	-	1	0.32	2.5
AN	*Chaetozone corona*	-	-	-	1	1	0.32	2.5
MO	*Cooperella subdiaphana*	-	-	1	-	1	0.32	2.5
MO	*Ennucula tenuis*	1	-	-	-	1	0.32	2.5
AN	*Exogone lourei*	-	-	1	-	1	0.32	2.5
AN	*Glycera macrobranchia*	-	-	1	-	1	0.32	2.5
AN	*Glycera* sp	1	-	-	-	1	0.32	2.5
AN	*Goniada littorea*	-	-	1	-	1	0.32	2.5
AR	*Jassa slatteryi*	-	1	-	-	1	0.32	2.5
AR	*Lamprops quadriplicatus*	1	-	-	-	1	0.32	2.5
AN	*Lumbrineris californiensis*	-	-	-	1	1	0.32	2.5
MO	*Macoma* sp	-	-	1	-	1	0.32	2.5
AN	*Magelona sacculata*	-	-	1	-	1	0.32	2.5
AN	Maldanidae	1	-	-	-	1	0.32	2.5
AN	*Malmgreniella macginitiei*	-	-	1	-	1	0.32	2.5
AR	*Nebalia daytoni*	1	-	-	-	1	0.32	2.5
AN	*Nephtys cornuta*	-	-	-	1	1	0.32	2.5
NE	*Paranemertes californica*	-	-	1	-	1	0.32	2.5
AN	*Paraprionospio pinnata*	-	-	1	-	1	0.32	2.5
MO	*Periploma planisculum*	-	-	1	-	1	0.32	2.5
AR	*Photis macinerneyi*	1	-	-	-	1	0.32	2.5
AN	*Phyllodoce hartmanae*	-	1	-	-	1	0.32	2.5
AN	*Phyllodoce* sp	-	-	-	1	1	0.32	2.5
AN	*Poecilochaetus johnsoni*	-	-	1	-	1	0.32	2.5
CN	*Renilla kollilkeri*	-	1	-	-	1	0.32	2.5
AN	*Scoloplos armiger* Cmplx	-	-	-	1	1	0.32	2.5

Appendix G-3. (Cont.).

Station B5

Phylum	Species	Replicate B5-I	B5-II	B5-III	B5-IV	Total	Percent Composition	Density No./m²
AN	*Sigalion spinosus*	-	-	-	1	1	0.32	2.5
MO	*Siliqua lucida*	-	1	-	-	1	0.32	2.5
MO	*Simomactra planulata*	-	-	-	1	1	0.32	2.5
SI	*Siphonosoma ingens*	1	-	-	-	1	0.32	2.5
AN	*Sphaerephesia similisetis*	1	-	-	-	1	0.32	2.5
AN	*Syllis (Typosyllis) farallonensis*	1	-	-	-	1	0.32	2.5
AR	*Tiron biocellata*	-	-	1	-	1	0.32	2.5

Summary

Parameter	Replicate B5-I	B5-II	B5-III	B5-IV	Station Total	Overall Mean	S.D.
Number of individuals	68	50	91	100	309	77.3	22.6
Number of species	35	23	40	35	77	33.3	7.2
Diversity (H')	3.29	2.83	3.29	2.91	3.58	3.08	0.24

Appendix G-3. (Cont.).

Station B6

Phylum	Species	Replicate B6-I	B6-II	B6-III	B6-IV	Total	Percent Composition	Density No./m²
AN	*Apoprionospio pygmaea*	197	199	210	188	794	64.92	1985.0
AN	*Armandia brevis*	40	43	26	33	142	11.61	355.0
EC	*Dendraster excentricus*	74	10	6	13	103	8.42	257.5
AR	*Lamprops carinatus*	19	2	3	3	27	2.21	67.5
AR	*Photis macinerneyi*	7	2	3	1	13	1.06	32.5
AR	*Rhepoxynius* sp A SCAMIT 1987	2	2	8	1	13	1.06	32.5
NE	*Zygonemertes virescens*	2	3	6	1	12	0.98	30.0
NE	*Carinoma mutabilis*	6	1	3	1	11	0.90	27.5
AR	*Rhepoxynius abronius*	4	-	2	1	7	0.57	17.5
AR	*Diastylopsis tenuis*	-	3	2	1	6	0.49	15.0
AN	*Owenia collaris*	3	2	-	1	6	0.49	15.0
AR	*Americhelidium shoemakeri*	1	1	-	3	5	0.41	12.5
MO	*Nassarius perpinguis*	3	-	-	2	5	0.41	12.5
NE	*Paranemertes californica*	1	1	-	3	5	0.41	12.5
AN	*Spiochaetopterus costarum*	2	2	-	1	5	0.41	12.5
AN	*Capitella capitata* Cmplx	1	-	2	1	4	0.33	10.0
AN	*Phyllodoce hartmanae*	-	2	1	1	4	0.33	10.0
AR	*Rhepoxynius menziesi*	1	-	1	2	4	0.33	10.0
MO	*Siliqua lucida*	2	1	1	-	4	0.33	10.0
NE	*Tubulanus polymorphus*	1	2	-	1	4	0.33	10.0
AN	*Dispio uncinata*	-	1	1	1	3	0.25	7.5
AN	*Magelona pitelkai*	1	1	1	-	3	0.25	7.5
AR	*Metamysidopsis elongata*	-	-	2	1	3	0.25	7.5
AN	*Onuphis* sp 1 Pt. Loma 1983	2	-	1	-	3	0.25	7.5
AR	*Campylaspis* sp C Myers & Benedict 1974	-	1	-	1	2	0.16	5.0
CO	Enteropneusta	-	-	2	-	2	0.16	5.0
AR	*Jassa slatteryi*	-	-	1	1	2	0.16	5.0
MO	*Mactromeris catilliformis*	-	1	1	-	2	0.16	5.0
NT	Nematoda	1	1	-	-	2	0.16	5.0
AN	*Scoloplos armiger* Cmplx	1	-	1	-	2	0.16	5.0
AN	*Spiophanes bombyx*	-	1	-	1	2	0.16	5.0
MO	*Tellina modesta*	-	-	1	1	2	0.16	5.0
EC	Amphiuridae	1	-	-	-	1	0.08	2.5
AR	*Aoroides inermis*	-	-	1	-	1	0.08	2.5
NE	*Cerebratulus* sp	-	1	-	-	1	0.08	2.5
AN	*Dipolydora socialis*	-	1	-	-	1	0.08	2.5
AR	*Edotia sublittoralis*	-	-	1	-	1	0.08	2.5
AR	*Ericthonius brasiliensis*	-	1	-	-	1	0.08	2.5
AR	*Lamprops quadriplicatus*	1	-	-	-	1	0.08	2.5
EC	*Leptosynapta* sp	-	-	1	-	1	0.08	2.5
CN	*Limnactiniidae* sp A SCAMIT 1989	-	1	-	-	1	0.08	2.5
MO	*Neverita reclusiana*	-	-	1	-	1	0.08	2.5
MO	*Olivella baetica*	-	1	-	-	1	0.08	2.5
AN	*Ophiodromus pugettensis*	1	-	-	-	1	0.08	2.5
AN	*Pectinaria californiensis*	-	1	-	-	1	0.08	2.5
PR	*Phoronis* sp	-	-	1	-	1	0.08	2.5
CN	*Renilla kollikeri*	1	-	-	-	1	0.08	2.5
MO	*Rochefortia tumida*	-	-	1	-	1	0.08	2.5
MO	*Sphenia fragilis*	-	1	-	-	1	0.08	2.5
PL	*Stylochoplana* sp	1	-	-	-	1	0.08	2.5
AN	*Syllis (Ehlersia) heterochaeta*	-	-	-	1	1	0.08	2.5
MO	*Tellina bodegensis*	1	-	-	-	1	0.08	2.5
AR	*Uromunna ubiquita*	-	-	-	1	1	0.08	2.5

Summary

Parameter	Replicate B6-I	B6-II	B6-III	B6-IV	Station Total	Overall Mean	S.D.
Number of individuals	377	289	291	266	1223	305.8	48.8
Number of species	28	29	29	27	53	28.3	1.0
Diversity (H')	1.67	1.33	1.33	1.28	1.54	1.40	0.18

Appendix G-4. Infaunal wet weight biomass data (g). Reliant Energy Ormond Beach generating station NPDES, 2001.

Sta-Rep	Annelida	Arthropoda	Mollusca	Echinodermata	Misc.	Total
B1-I	0.924	0.044	0.008	0.015	0.027	1.018
B1-II	0.207	0.009	0.019	-	0.047	0.282
B1-III	0.005	0.025	0.004	0.002	0.006	0.042
B1-IV	0.124	0.018	0.001	0.261	0.011	0.415
Total	1.260	0.096	0.032	0.278	0.091	1.757
B2-I	0.086	0.040	0.083	0.006	0.045	0.260
B2-II	0.182	0.002	0.031	0.008	0.035	0.258
B2-III	0.281	0.005	0.028	0.007	0.008	0.329
B2-IV	0.017	0.021	0.015	0.028	0.003	0.084
Total	0.566	0.068	0.157	0.049	0.091	0.931
B3-I	0.141	0.093	0.037	0.074	0.054	0.399
B3-II*	0.036	0.005	0.007	2.723	0.003	2.774
B3-III	0.350	0.046	0.028	1.402	0.016	1.842
B3-IV	0.081	0.015	0.031	0.006	0.082	0.215
Total	0.608	0.159	0.103	4.205	0.155	5.230
B4-I	0.047	0.030	0.061	0.078	0.026	0.242
B4-II	0.039	0.002	0.006	0.029	0.637	0.713
B4-III	0.022	0.111	0.079	0.018	0.014	0.244
B4-IV	0.120	0.022	0.030	0.001	0.001	0.174
Total	0.228	0.165	0.176	0.126	0.678	1.373
B5-I	0.441	0.004	0.008	0.010	0.039	0.502
B5-II	0.020	0.019	0.059	0.042	0.009	0.149
B5-III*	0.204	0.012	0.013	2.857	0.013	3.099
B5-IV	0.087	0.020	0.051	1.476	0.037	1.670
Total	0.752	0.055	0.131	4.385	0.098	5.420
B6-I	0.327	0.559	0.014	0.024	0.035	0.959
B6-II	0.227	0.007	0.012	0.014	0.023	0.283
B6-III	0.285	0.012	0.006	<0.001	0.016	0.319
B6-IV	0.236	0.094	0.007	0.011	0.005	0.353
Total	1.075	0.672	0.039	0.049	0.079	1.914
Grand Total	4.489	1.215	0.638	9.092	1.192	16.625

Note: - = no animals

* includes *Amphiodia psera*

Appendix G-5. Yearly infaunal abundance. Reliant Energy Ormond Beach generating station NPDES, 2001.

		Year															Percent	Cum.	
Phylum	Species	1978	1980	1986	1988	1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	Total	Total	Percent	F.O.
NT	Nematoda	7	5	-	2	6	2	-	-	5	8375	-	5	24	6	8437	24.93	24.93	10
AN	*Owenia collaris*	3	2	-	6	4	82	-	-	2	5	10	59	3275	111	3559	10.52	35.44	11
AN	*Apoprionospio pygmaea*	29	108	9	464	42	509	17	12	156	43	41	94	53	948	2525	7.46	42.90	14
AR	*Diastylopsis tenuis*	306	110	28	80	59	23	1	19	62	67	1	391	728	136	2011	5.94	48.85	14
EC	*Dendraster excentricus*	8	11	7	9	9	-	4	5	33	1075	31	32	118	360	1702	5.03	47.93	13
AR	*Rhepoxynius menziesi*	32	57	27	45	44	26	14	11	50	16	24	137	256	48	787	2.33	50.26	14
AN	*Mediomastus acutus*	28	30	-	-	-	-	-	2	27	66	282	86	124	94	739	2.18	52.44	9
MO	*Tellina modesta*	8	48	23	13	29	5	3	1	32	22	13	105	316	106	724	2.14	54.58	14
AN	*Pectinaria californiensis*	3	-	1	123	2	-	-	1	-	15	1	465	46	19	676	2.00	56.58	10
MO	*Siliqua lucida*	1	17	17	10	-	7	-	22	29	31	15	473	11	14	647	1.91	58.49	12
AN	*Spiophanes bombyx*	9	39	22	53	22	17	28	24	33	19	13	32	63	33	407	1.20	59.69	14
AR	*Photis macinerneyi*	-	-	4	66	12	1	-	-	5	43	2	72	166	29	400	1.18	60.87	10
AN	*Magelona sacculata*	7	100	37	127	27	66	12	3	-	-	-	-	5	8	392	1.16	62.03	10
AN	*Armandia brevis*	1	2	-	1	-	3	-	-	3	-	1	23	3	324	361	1.07	63.10	9
AR	*Anchicolurus occidentalis*	5	6	7	15	10	12	3	1	15	17	1	98	123	13	326	0.96	64.06	14
AR	*Aoroides inermis*	-	-	-	-	-	-	-	-	-	-	-	188	43	60	291	0.86	64.92	3
AR	*Rhepoxynius abronius*	9	24	1	8	8	28	8	-	5	6	5	14	108	65	289	0.85	65.78	13
AR	*Gibberosus myersi*	7	3	4	9	5	18	-	-	11	11	2	31	140	37	278	0.82	66.60	12
AR	*Photis brevipes*	6	-	-	-	3	2	-	-	5	1	15	106	122	14	274	0.81	67.41	9
NE	*Carinoma mutabilis*	-	4	9	12	13	13	32	10	20	43	22	16	19	54	267	0.79	68.20	13
AN	*Aricidea (Acmira) catherinae*	26	70	6	18	10	12	21	5	12	8	2	11	9	39	249	0.74	68.93	14
AR	*Euphilomedes longiseta*	-	10	-	-	1	-	-	-	-	-	-	63	163	-	237	0.70	69.63	4
AN	*Scoloplos armiger* Cmplx	7	6	21	25	28	43	19	5	18	43	11	5	1	3	235	0.69	70.33	14
AN	*Goniada littorea*	42	18	9	10	24	20	4	6	15	14	12	27	17	10	228	0.67	71.00	14
AN	*Capitella capitata* Cmplx	-	1	191	-	-	14	-	-	-	-	-	-	1	4	211	0.62	71.62	5
AR	*Isocheles pilosus*	1	4	3	9	3	-	-	-	-	-	-	1	176	-	197	0.58	72.21	7
AR	*Jassa slatteryi*	-	-	-	-	9	-	-	-	-	-	-	93	86	4	192	0.57	72.77	4
AN	*Mediomastus* spp	2	20	-	37	34	6	3	-	-	13	46	12	6	-	179	0.53	72.73	10
AN	*Chaetozone setosa* Cmplx	10	14	2	6	55	16	13	2	5	8	12	-	-	5	148	0.44	73.17	12
AN	*Exogone lourei*	3	1	-	-	24	2	1	-	6	52	6	18	21	8	142	0.42	73.59	11
AR	*Ericthonius brasiliensis*	-	-	-	-	-	-	-	-	-	-	-	130	3	6	139	0.41	74.00	3
MO	*Cooperella subdiaphana*	-	-	2	7	3	-	-	-	-	5	4	18	90	10	139	0.41	74.41	8
AR	*Americhelidium shoemakeri*	25	-	2	5	-	-	-	-	1	-	-	11	77	13	134	0.40	74.81	7
AN	*Magelona pitelkai*	1	68	-	3	9	23	4	1	3	2	-	-	3	11	128	0.38	75.19	11
AR	*Uromunna ubiquita*	5	5	-	1	-	-	-	-	2	1	-	1	102	10	127	0.38	75.56	8
MO	*Modiolus* sp	-	-	-	-	1	-	-	-	1	-	8	16	92	6	124	0.37	75.93	6
NE	Nemertea	18	10	7	18	13	3	8	2	6	6	3	7	15	6	122	0.36	76.29	14
AR	*Lamprops carinatus*	1	1	-	-	1	1	-	-	-	2	-	11	63	39	119	0.35	76.64	8
AN	*Nephtys caecoides*	8	7	4	10	13	8	5	2	12	4	3	18	16	6	116	0.34	76.98	14
AN	*Spiophanes duplex*	-	31	-	52	3	4	-	7	2	1	8	-	3	5	116	0.34	77.33	10
AR	*Ampelisca agassizi*	-	1	1	16	64	10	2	-	4	3	-	1	5	4	111	0.33	77.65	11
MO	*Rochefortia tumida*	4	6	2	1	1	-	-	-	1	1	-	4	45	45	110	0.33	77.98	10
AN	*Spiochaetopterus costarum*	15	6	-	32	-	-	-	-	6	3	1	3	11	24	101	0.30	78.28	9
MO	*Mysella* sp H SCAMIT 2001	2	11	11	75	-	-	-	-	-	-	-	1	-	-	100	0.30	78.57	5
AN	*Onuphis* sp 1 Pt. Loma 1983	-	-	-	-	-	-	-	-	-	35	13	7	17	24	96	0.28	78.86	5
AR	*Caprella verrucosa*	-	-	-	-	-	-	-	-	-	-	-	-	96	-	96	0.28	79.14	1
AR	*Edotia sublittoralis*	3	1	3	1	2	6	-	1	10	12	1	10	35	8	93	0.27	79.41	13
AN	*Syllis* sp	-	2	-	22	35	12	13	3	-	-	-	-	3	-	90	0.27	79.68	7
AR	*Photis* sp	52	18	-	-	1	9	-	-	-	-	-	-	-	-	80	0.24	79.92	4
AN	*Sigalion spinosus*	5	14	4	11	4	1	5	1	10	2	3	4	4	11	79	0.23	80.15	14
PR	*Phoronis* sp	14	8	-	17	-	-	-	-	-	-	-	6	11	21	77	0.23	80.38	6
AR	*Cumella californica*	-	1	-	-	-	-	-	-	3	17	-	6	39	9	75	0.22	80.60	6
CO	Enteropneusta	10	2	-	-	8	-	-	-	-	4	2	5	23	20	74	0.22	80.82	8
NE	*Paranemertes californica*	-	3	-	4	5	-	-	-	4	6	8	5	21	18	74	0.22	81.04	9
NE	*Tubulanus polymorphus*	-	-	1	2	3	11	-	-	4	5	1	1	21	23	72	0.21	81.25	10
AR	*Lamprops quadriplicatus*	1	1	-	1	2	3	-	-	20	8	-	19	11	5	71	0.21	81.46	10
MO	*Macoma* sp	-	9	-	1	3	-	-	-	9	11	-	-	27	10	70	0.21	81.67	7
AN	*Glycera macrobranchia*	3	4	1	5	4	4	5	3	6	12	4	2	5	10	68	0.20	81.87	14
AR	*Foxiphalus obtusidens*	1	-	-	-	1	-	-	-	4	2	-	33	20	7	68	0.20	82.07	7
AN	*Dispio uncinata*	7	25	7	10	1	1	-	-	-	1	-	1	5	7	65	0.19	82.26	10
AN	*Syllis (Typosyllis) aciculata*	35	29	-	-	-	-	-	-	-	-	-	-	-	-	64	0.19	82.45	2
AR	*Rhepoxynius* sp A SCAMIT 1987	12	7	3	5	-	3	2	1	5	-	-	4	5	14	61	0.18	82.63	11
AN	*Glycinde armigera*	-	-	1	11	2	-	-	-	5	19	12	1	5	3	59	0.17	82.80	9
AN	*Scoletoma tetraura* Cmplx	1	8	4	4	2	-	-	11	8	8	-	4	9	-	59	0.17	82.98	10
CN	Actiniaria	-	1	-	-	6	6	-	-	-	-	-	-	41	5	59	0.17	83.15	5
AR	Phoxocephalidae	-	-	-	6	1	40	10	-	-	-	-	-	-	-	57	0.17	83.32	4
AR	*Balanus pacificus*	-	-	3	2	-	-	-	-	-	-	-	-	17	31	53	0.16	83.48	4
AR	*Anoropallene palpida*	-	-	-	2	-	-	-	-	-	20	-	1	24	5	52	0.15	83.63	5
PR	Phoronida	-	3	7	-	9	3	-	-	7	19	4	-	-	-	52	0.15	83.78	7
AN	*Tharyx* spp Cmplx	33	13	-	-	1	1	-	1	-	-	-	-	-	-	49	0.14	83.93	5
AN	*Lumbrineris* spp	4	4	-	3	4	15	11	1	-	2	2	-	-	1	47	0.14	84.07	10
AN	*Pista disjuncta*	5	1	1	2	18	1	2	-	-	-	10	4	2	-	46	0.14	84.20	10
CN	*Zaolutus actius*	-	2	-	4	-	-	-	-	-	-	-	13	26	1	46	0.14	84.34	5

Appendix G-5. (Cont.).

Phylum	Species	1978	1980	1986	1988	1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	Total	Percent Total	Cum. Percent	F.O.
AN	*Brania californiensis*	-	-	-	-	2	-	-	-	-	-	-	6	32	4	44	0.13	84.47	4
AN	*Phyllodoce hartmanae*	-	-	-	14	3	7	2	-	-	-	1	-	11	6	44	0.13	84.60	7
AR	*Campylaspis* sp C Myers & Benedict 1974	-	1	-	6	1	2	-	-	12	2	1	9	6	4	44	0.13	84.73	10
NE	Lineidae	-	-	-	4	-	-	-	-	5	9	1	3	10	12	44	0.13	84.86	7
AN	*Polydora cirrosa*	-	-	-	-	-	-	-	-	-	-	-	17	23	3	43	0.13	84.99	3
AR	*Leuroleberis sharpei*	-	1	1	5	10	3	-	-	1	-	3	7	7	3	41	0.12	85.11	10
AN	*Onuphis iridescens*	2	4	3	12	7	12	-	-	-	-	-	-	-	-	40	0.12	85.23	6
AN	*Syllis (Typosyllis) farallonensis*	-	-	1	-	-	-	-	-	14	14	5	3	-	2	39	0.12	85.34	6
AR	*Cyclaspis nubila*	-	-	-	3	1	-	-	-	8	5	-	16	5	1	39	0.12	85.46	7
AR	*Euphilomedes carcharodonta*	1	8	1	4	2	1	-	-	5	10	-	1	3	3	39	0.12	85.57	11
AR	*Ischyrocerus pelagops*	-	-	-	-	-	-	-	-	-	-	-	7	29	-	36	0.11	85.68	2
AR	*Jassa marmorata*	-	-	-	-	-	-	-	-	-	-	-	25	11	-	36	0.11	85.79	2
MO	*Nassarius perpinguis*	-	2	4	-	4	-	-	-	2	9	-	1	8	6	36	0.11	85.89	8
AN	*Syllides* sp	15	13	-	1	-	-	-	-	-	-	1	4	1	-	35	0.10	85.99	6
MO	*Mactromeris catilliformis*	-	-	-	-	-	-	-	-	-	-	-	-	-	35	35	0.10	86.10	1
AN	*Ampharete labrops*	5	1	-	1	-	-	-	3	5	-	10	2	4	3	34	0.10	86.20	9
AR	*Monocorophium acherusicum*	-	-	-	5	2	-	-	-	-	-	-	-	27	-	34	0.10	86.30	3
AN	*Neosabellaria cementarium*	-	-	-	-	-	-	-	-	-	1	4	21	5	2	33	0.10	86.40	5
AR	*Cerapus tubularis* Cmplx	-	2	-	-	4	-	-	4	4	-	1	5	10	3	33	0.10	86.49	8
AR	*Rhepoxynius* sp	13	-	-	1	16	-	3	-	-	-	-	-	-	-	33	0.10	86.59	4
BC	*Glottidia albida*	4	1	3	3	5	-	-	1	3	5	1	1	3	2	32	0.09	86.69	12
MO	*Olivella baetica*	-	7	1	3	3	1	-	-	1	12	-	-	2	2	32	0.09	86.78	9
AN	*Dorvillea (Schistomeringos) longicornis*	-	-	-	-	-	-	-	-	30	1	-	-	-	-	31	0.09	86.87	2
AN	*Syllis (Ehlersia) heterochaeta*	-	-	-	-	-	-	-	-	-	-	12	7	8	4	31	0.09	86.96	4
AN	*Onuphis eremita*	4	-	-	-	3	1	1	15	2	2	1	1	-	-	30	0.09	87.05	9
MO	*Cyclostremella dalli*	-	-	-	2	-	-	-	-	-	-	1	-	27	-	30	0.09	87.14	3
MO	*Protothaca staminea*	-	-	-	-	-	-	-	-	-	1	-	2	24	3	30	0.09	87.23	4
AR	*Cyclaspis* sp C SCAMIT 1986	-	1	-	2	-	2	-	-	-	9	-	8	4	3	29	0.09	87.32	7
AR	*Tiron biocellata*	-	-	-	1	-	4	-	-	2	-	-	13	5	3	28	0.08	87.40	6
EC	*Amphiodia urtica*	4	2	2	2	2	5	4	6	-	-	-	-	-	-	27	0.08	87.48	8
AN	*Phyllodoce* sp	1	19	-	1	-	1	-	-	2	-	-	1	-	1	26	0.08	87.56	7
AN	*Sthenelais verruculosa*	6	2	3	1	1	2	-	5	1	-	-	3	2	-	26	0.08	87.63	10
AR	*Rhepoxynius stenodes*	-	1	-	-	1	-	-	-	-	2	3	16	-	-	23	0.07	87.70	5
AN	*Carazziella* sp A SCAMIT 1995	-	-	-	-	-	-	-	-	-	-	-	-	-	22	22	0.07	87.76	1
AN	*Diopatra ornata*	-	-	-	-	-	1	-	-	-	2	-	10	8	1	22	0.07	87.83	5
AR	*Metharpinia jonesi*	5	6	-	-	-	-	-	-	3	8	-	-	-	-	22	0.07	87.89	4
AR	*Photis macrotica*	17	5	-	-	-	-	-	-	-	-	-	-	-	-	22	0.07	87.96	2
AR	*Podocerus brasiliensis*	-	-	-	-	-	-	-	-	-	-	-	-	22	-	22	0.07	88.02	1
AN	*Leitoscoloplos pugettensis*	1	2	4	-	4	-	-	-	2	-	6	-	-	2	21	0.06	88.09	7
AN	Onuphidae	1	-	-	1	2	-	-	1	6	5	-	-	5	-	21	0.06	88.15	7
AR	*Hartmanodes hartmanae*	1	1	2	2	3	1	1	-	2	-	-	1	6	1	21	0.06	88.21	11
AR	*Rutiderma rostratum*	2	-	-	3	1	-	-	-	-	3	1	2	5	4	21	0.06	88.27	8
CN	*Limnactiniidae* sp A SCAMIT 1989	-	-	-	-	1	-	-	-	3	3	3	-	3	8	21	0.06	88.34	6
MO	*Rochefortia grippi*	-	7	-	-	1	-	-	-	-	-	-	-	13	-	21	0.06	88.40	3
AN	*Podarkeopsis glabrus*	-	4	-	1	6	3	2	-	1	-	1	-	2	-	20	0.06	88.46	8
AN	*Paraprionospio pinnata*	1	1	1	1	1	1	-	-	4	3	-	-	2	4	19	0.06	88.51	10
AN	*Polyophthalmus pictus*	-	-	-	-	-	17	-	-	-	2	-	-	-	-	19	0.06	88.57	2
AN	*Prionospio (Minuspio) lighti*	-	3	-	1	1	4	-	-	-	-	-	1	-	9	19	0.06	88.62	6
AR	*Hemilamprops californicus*	2	1	-	7	-	-	-	-	4	-	-	3	2	-	19	0.06	88.68	6
AN	*Monticellina cryptica*	-	-	-	-	-	-	-	-	-	2	3	6	3	4	18	0.05	88.73	5
AR	*Anoplodactylus erectus*	-	-	-	-	-	-	-	-	-	-	-	-	18	-	18	0.05	88.79	1
AR	*Asteropella slatteryi*	-	-	-	-	-	-	-	-	1	-	1	10	4	2	18	0.05	88.84	5
AR	*Eohaustorius barnardi*	13	5	-	-	-	-	-	-	-	-	-	-	-	-	18	0.05	88.89	2
AR	*Monocorophium* sp	-	-	-	-	-	-	-	-	-	-	-	17	-	1	18	0.05	88.95	2
CN	*Edwardsia californica*	-	18	-	-	-	-	-	-	-	-	-	-	-	-	18	0.05	89.00	1
AN	*Metasychis disparidentatus*	1	-	-	1	-	2	-	2	4	5	1	-	1	-	17	0.05	89.05	8
AN	*Amaeana occidentalis*	3	1	-	-	-	-	6	-	-	1	5	-	-	-	16	0.05	89.10	5
AN	*Nephtys cornuta*	-	4	-	2	2	-	-	-	1	3	-	-	-	4	16	0.05	89.14	6
AR	*Americhelidium rectipalmum*	-	-	-	3	-	-	-	-	-	-	-	2	8	3	16	0.05	89.19	4
AN	*Goniada maculata*	-	-	1	2	2	-	6	-	1	-	-	1	2	-	15	0.04	89.24	7
AR	*Rhepoxynius variatus*	-	-	-	1	7	1	1	2	-	-	-	2	-	1	15	0.04	89.28	7
MO	*Neverita reclusiana*	-	-	-	2	1	-	-	-	-	-	-	-	10	2	15	0.04	89.32	4
AN	*Eumida longicornuta*	-	-	-	-	-	-	-	-	-	-	-	11	1	2	14	0.04	89.37	3
AR	*Aoroides* sp	-	-	-	-	-	-	-	-	3	-	10	-	1	-	14	0.04	89.41	3
AR	*Zeugophilomedes oblongatus*	-	-	-	1	2	-	-	-	-	-	-	-	8	3	14	0.04	89.45	4
NE	*Carinomella lactea*	-	11	-	-	-	-	-	-	3	-	-	-	-	-	14	0.04	89.49	2
NE	*Cerebratulus californiensis*	-	-	-	8	-	2	2	-	-	-	-	2	-	-	14	0.04	89.53	4
AN	*Chone* sp SD 1 Pt. Loma 1997	-	-	-	-	-	-	-	-	-	-	3	1	6	3	13	0.04	89.57	4
AN	*Diopatra splendidissima*	-	-	2	-	-	-	-	1	-	-	3	-	5	2	13	0.04	89.61	5
AN	*Heteropodarke heteromorpha*	-	6	1	3	-	-	-	-	3	-	-	-	-	-	13	0.04	89.65	4
AR	*Metatiron tropakis*	4	1	2	-	2	-	-	-	2	1	-	1	-	-	13	0.04	89.69	7
AR	*Nymphon* sp	-	-	3	-	-	-	-	10	-	-	-	-	-	-	13	0.04	89.72	2
AR	*Rhepoxynius homocuspidatus*	-	-	-	13	-	-	-	-	-	-	-	-	-	-	13	0.04	89.76	1
EC	Echinoidea	2	3	-	-	-	1	-	7	-	-	-	-	-	-	13	0.04	89.76	4

Appendix G-5. (Cont.).

Phylum	Species	1978	1980	1986	1988	1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	Total	Percent Total	Cum. Percent	F.O.
EC	*Leptosynapta* sp	2	-	-	-	-	-	1	2	2	-	-	1	1	4	13	0.04	89.80	7
MO	*Rictaxis punctocaelatus*	1	1	-	1	-	-	-	-	-	3	2	-	3	2	13	0.04	89.84	7
PR	*Phoronopsis* sp	-	-	-	-	-	-	-	-	-	-	-	-	9	4	13	0.04	89.88	2
AN	*Malmgreniella macginitiei*	1	1	1	1	-	-	-	2	-	-	-	1	-	5	12	0.04	89.91	7
AR	*Americhelidium* sp	3	9	-	-	-	-	-	-	-	-	-	-	-	-	12	0.04	89.95	2
EC	*Amphiodia* sp	-	-	-	-	-	1	-	-	4	1	1	3	2	-	12	0.04	89.98	6
MO	*Crepidula naticarum*	-	-	1	2	-	-	-	-	2	-	2	-	5	-	12	0.04	90.02	5
NE	*Zygonemertes virescens*	-	-	-	-	-	-	-	-	-	-	-	-	-	12	12	0.04	90.05	1
AN	*Boccardia* sp	-	11	-	-	-	-	-	-	-	-	-	-	-	-	11	0.03	90.09	1
AN	*Eupolymnia heterobranchia*	-	-	-	-	-	-	-	-	-	-	-	3	5	3	11	0.03	90.12	3
AN	*Glycera* sp	2	2	-	3	-	2	-	1	-	-	-	-	-	1	11	0.03	90.15	6
AN	*Hesionella mccullochae*	-	-	-	-	-	-	-	-	-	2	1	1	7	-	11	0.03	90.18	4
AN	*Magelona* sp	-	11	-	-	-	-	-	-	-	-	-	-	-	-	11	0.03	90.22	1
AN	*Nephtys* sp	-	2	-	2	-	7	-	-	-	-	-	-	-	-	11	0.03	90.25	3
AN	*Phyllodoce longipes*	-	-	-	-	-	-	-	-	1	-	-	-	5	5	11	0.03	90.28	3
AN	*Polydora* sp	-	-	-	10	-	-	-	-	-	-	1	-	-	-	11	0.03	90.31	2
MO	*Leptopecten latiauratus*	-	-	-	-	1	-	-	-	-	-	5	2	2	1	11	0.03	90.35	5
MO	*Mactrotoma californica*	-	-	-	-	-	-	-	-	-	-	-	3	8	-	11	0.03	90.38	2
MO	*Nassarius* sp	-	-	-	11	-	-	-	-	-	-	-	-	-	-	11	0.03	90.41	1
MO	*Yoldia cooperi*	-	-	-	-	-	-	-	-	-	-	-	-	11	-	11	0.03	90.44	1
NE	*Tetrastemma* sp A SCAMIT 1995	-	-	-	-	-	-	-	-	-	-	1	7	3	-	11	0.03	90.48	3
SI	*Apionsoma misakianum*	-	1	1	-	6	-	-	-	-	-	-	3	-	-	11	0.03	90.51	4
SI	*Siphonosoma ingens*	-	-	-	-	-	-	-	-	3	-	-	-	4	4	11	0.03	90.54	3
AN	*Lumbrineris californiensis*	-	-	1	1	-	-	-	-	3	4	-	-	-	1	10	0.03	90.57	5
AN	*Magelona californica*	-	-	-	-	-	-	-	-	-	-	-	-	10	-	10	0.03	90.60	1
AN	*Polydora cornuta*	-	-	-	-	-	-	-	1	-	-	-	-	-	9	10	0.03	90.63	2
AR	Gammaridea	1	1	-	-	1	6	-	-	1	-	-	-	-	-	10	0.03	90.66	5
AR	*Rudilemboides stenopropodus*	-	-	-	-	10	-	-	-	-	-	-	-	-	-	10	0.03	90.69	1
AR	*Tritella pilimana*	-	-	-	-	-	-	-	-	-	-	-	-	10	-	10	0.03	90.72	1
EC	*Amphiodia psara*	1	1	1	-	1	-	-	-	1	-	1	1	1	2	10	0.03	90.75	9
PL	*Stylochoplana* sp	-	3	-	-	-	-	-	-	1	1	2	2	-	1	10	0.03	90.78	6
AN	Euclymeninae	-	-	-	-	1	6	1	1	-	-	-	-	-	-	9	0.03	90.81	4
AN	*Nereis latescens*	-	-	-	-	-	-	-	-	1	-	-	1	2	5	9	0.03	90.83	4
AN	*Sphaerephesia similisetis*	-	-	-	-	-	-	-	-	1	1	-	2	2	3	9	0.03	90.86	5
EC	Ophiuroidea	1	1	1	-	-	2	-	-	4	-	-	-	-	-	9	0.03	90.88	5
AN	*Chone albocincta*	-	-	-	-	1	-	-	-	4	3	-	-	-	-	8	0.02	90.91	3
AN	Maldanidae	2	-	-	-	-	-	1	1	-	-	-	-	1	3	8	0.02	90.93	5
AR	*Atylus tridens*	1	-	-	7	-	-	-	-	-	-	-	-	-	-	8	0.02	90.96	2
AR	*Cancer* sp	-	-	-	-	-	-	-	-	1	-	-	4	2	1	8	0.02	90.98	4
AR	*Joeropsis lobata*	-	-	-	-	-	-	-	-	-	-	-	8	-	-	8	0.02	91.00	1
CN	Hydrozoa	1	2	3	-	2	-	-	-	-	-	-	-	-	-	8	0.02	91.03	4
EC	Amphiuridae	-	-	-	-	-	-	-	-	7	-	-	-	-	1	8	0.02	91.05	2
MO	*Chione* sp	-	-	8	-	-	-	-	-	-	-	-	-	-	-	8	0.02	91.07	1
AN	*Tenonia priops*	-	-	-	3	-	-	-	-	2	-	-	1	1	-	7	0.02	91.09	4
AR	*Metamysidopsis elongata*	-	-	-	2	-	-	-	-	-	1	-	-	1	3	7	0.02	91.12	4
CN	Anthozoa	-	2	1	2	2	-	-	-	-	-	-	-	-	-	7	0.02	91.14	4
MO	*Balcis oldroydae*	2	3	-	-	1	-	-	-	-	-	-	-	-	1	7	0.02	91.16	4
MO	Bivalvia	-	2	-	-	1	1	-	1	2	-	-	-	-	-	7	0.02	91.18	5
MO	*Macoma secta*	-	-	-	2	-	-	1	-	-	1	-	3	-	-	7	0.02	91.20	4
MO	*Macoma yoldiformis*	-	1	1	2	-	-	-	-	1	-	-	-	1	1	7	0.02	91.22	6
MO	*Pandora bilirata*	-	-	-	-	-	-	-	-	-	1	-	-	3	3	7	0.02	91.24	3
MO	*Periploma discus*	-	5	-	-	-	-	-	-	-	2	-	-	-	-	7	0.02	91.26	2
MO	*Periploma planiusculum*	1	-	-	2	-	-	-	-	-	-	-	-	1	3	7	0.02	91.28	4
AN	*Aphelochaeta glandaria*	-	-	-	-	-	-	-	-	-	2	1	3	-	-	6	0.02	91.30	3
AN	*Glycera nana*	-	-	1	2	-	-	-	-	-	2	-	1	-	-	6	0.02	91.32	4
AN	*Heteromastus* sp	-	-	1	-	-	-	5	-	-	-	-	-	-	-	6	0.02	91.33	2
AN	*Mediomastus californiensis*	-	-	-	-	-	-	-	-	-	-	-	-	-	6	6	0.02	91.35	1
AN	*Nereis procera*	1	-	-	-	1	-	-	-	1	-	3	-	-	-	6	0.02	91.37	4
AR	*Argissa hamatipes*	2	2	-	-	-	-	-	-	2	-	-	-	-	-	6	0.02	91.39	3
AR	*Callipallene californiensis*	4	-	-	-	-	2	-	-	-	-	-	-	-	-	6	0.02	91.40	2
AR	*Lepidepecreum serraculum*	-	-	-	-	1	-	-	-	1	-	-	-	3	1	6	0.02	91.42	4
AR	*Leptocuma forsmani*	-	-	-	-	2	-	-	-	1	-	-	3	-	-	6	0.02	91.44	3
AR	*Stenothoe valida*	-	-	-	-	6	-	-	-	-	-	-	-	-	-	6	0.02	91.46	1
MO	*Acteocina culcitella*	-	-	1	-	-	-	1	-	1	-	-	-	-	3	6	0.02	91.48	4
MO	*Ennucula tenuis*	-	-	-	-	-	-	-	-	-	2	1	-	-	3	6	0.02	91.49	3
MO	Mytilidae	-	-	-	5	-	-	-	-	-	1	-	-	-	-	6	0.02	91.51	2
MO	*Mytilus* sp	-	-	-	5	-	-	-	-	-	-	-	1	-	-	6	0.02	91.53	2
PL	Platyhelminthes	4	-	-	-	-	-	2	-	-	-	-	-	-	-	6	0.02	91.55	2
AN	*Chone mollis*	1	-	-	-	-	-	1	2	-	-	-	-	1	-	5	0.01	91.56	4
AN	*Dipolydora bidentata*	-	-	-	-	1	-	-	-	3	-	-	-	1	-	5	0.01	91.58	3
AN	*Dipolydora socialis*	-	-	-	1	-	-	-	-	-	-	-	-	-	4	5	0.01	91.59	2
AN	*Eteone balboensis*	2	2	1	-	-	-	-	-	-	-	-	-	-	-	5	0.01	91.61	3
AN	*Eteone* sp	-	-	-	2	-	3	-	-	-	-	-	-	-	-	5	0.01	91.62	2

Appendix G-5. (Cont.).

Phylum	Species	1978	1980	1986	1988	1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	Total	Percent Total	Cum. Percent	F.O.
AN	*Glycera americana*	-	-	-	-	1	2	-	-	-	2	-	-	-	-	5	0.01	91.64	3
AN	*Nereiphylla castanea*	-	-	-	-	-	-	-	-	1	-	-	4	-	-	5	0.01	91.65	2
AN	*Sphaerosyllis californiensis*	-	-	-	-	-	-	-	-	-	-	1	-	4	-	5	0.01	91.66	2
AN	*Sthenelais tertiaglabra*	-	-	-	-	-	-	-	-	-	1	4	-	-	-	5	0.01	91.68	2
AR	Calanoida	5	-	-	-	-	-	-	-	-	-	-	-	-	-	5	0.01	91.69	1
AR	*Caprella californica*	-	-	-	-	-	-	-	-	-	-	-	-	5	-	5	0.01	91.71	1
AR	*Eochelidium* sp A SCAMIT 1996	-	-	-	-	-	5	-	-	-	-	-	-	-	-	5	0.01	91.72	1
AR	*Eohaustorius sawyeri*	-	-	-	-	-	-	-	-	-	-	-	5	-	-	5	0.01	91.74	1
AR	*Gammaropsis thompsoni*	-	-	-	-	-	-	-	-	1	-	-	1	-	3	5	0.01	91.75	3
AR	*Lepidopa californica*	-	1	2	1	-	-	-	1	-	-	-	-	-	-	5	0.01	91.77	4
AR	*Paracerceis* sp	-	-	-	-	-	-	-	-	-	-	-	-	5	-	5	0.01	91.78	1
AR	*Pinnixa* sp	2	1	-	-	1	1	-	-	-	-	-	-	-	-	5	0.01	91.80	4
AR	*Randallia ornata*	-	-	1	-	3	-	-	-	-	-	-	1	-	-	5	0.01	91.81	3
AR	*Rhepoxynius* sp H	-	-	-	-	-	-	5	-	-	-	-	-	-	-	5	0.01	91.83	1
EC	*Amphiodia digitata*	-	2	-	-	-	-	-	-	-	-	-	2	1	-	5	0.01	91.84	3
MO	*Crepidula* sp	-	-	-	-	1	-	-	-	-	-	-	-	-	4	5	0.01	91.86	2
MO	*Macoma nasuta*	-	-	-	3	-	-	-	-	-	-	2	-	-	-	5	0.01	91.87	2
MO	*Tellina bodegensis*	1	-	-	-	-	-	-	-	1	-	-	1	1	1	5	0.01	91.89	5
PL	*Imogine exiguus*	-	-	-	-	-	-	-	-	3	1	1	-	-	-	5	0.01	91.90	3
SI	*Thysanocardia nigra*	-	-	-	-	-	-	-	-	2	-	-	1	2	-	5	0.01	91.92	3
AN	*Arabella endonata*	-	-	-	-	1	-	-	-	2	-	-	-	1	-	4	0.01	91.93	3
AN	*Cirriformia spirabrancha*	-	-	1	-	-	-	1	-	1	1	-	-	-	-	4	0.01	91.94	4
AN	*Onuphis* sp	-	-	-	3	-	-	-	1	-	-	-	-	-	-	4	0.01	91.95	2
AN	*Pista elongata*	-	-	-	-	-	-	-	-	-	-	-	1	-	3	4	0.01	91.96	2
AN	Polychaeta	-	-	-	-	-	-	-	1	1	-	-	-	-	2	4	0.01	91.98	3
AN	*Polycirrus* sp	-	-	1	-	-	-	1	2	-	-	-	-	-	-	4	0.01	91.99	3
AN	*Protodorvillea gracilis*	-	-	-	3	-	1	-	-	-	-	-	-	-	-	4	0.01	92.00	2
AN	*Spiophanes berkeleyorum*	-	1	-	-	-	-	-	-	1	-	-	-	1	1	4	0.01	92.01	4
AR	*Balanus* sp	-	-	1	-	-	-	-	-	1	2	-	-	-	-	4	0.01	92.02	3
AR	*Cancer antennarius*	-	-	-	-	-	-	-	-	-	1	-	-	1	2	4	0.01	92.03	3
AR	*Caprella mendax*	-	-	-	-	-	-	-	-	-	-	-	-	4	-	4	0.01	92.05	1
AR	*Euphilomedes* sp	-	-	-	-	1	3	-	-	-	-	-	-	-	-	4	0.01	92.06	2
AR	*Exosphaeroma rhomburum*	-	-	-	-	-	-	-	-	3	-	-	-	1	-	4	0.01	92.07	2
AR	*Gnathopleustes serratus*	-	-	-	-	-	2	-	-	2	-	-	-	-	-	4	0.01	92.08	2
AR	*Mandibulophoxus gilesi*	1	-	-	-	-	1	1	1	-	-	-	-	-	-	4	0.01	92.09	4
AR	*Munnogonium tillerae*	-	-	-	-	-	4	-	-	-	-	-	-	-	-	4	0.01	92.11	1
AR	*Neotrypaea californiensis*	-	-	1	2	-	-	-	-	-	-	-	-	-	1	4	0.01	92.12	3
AR	*Photis californica*	-	2	-	-	-	2	-	-	-	-	-	-	-	-	4	0.01	92.13	2
AR	*Pyromaia tuberculata*	-	-	-	-	-	-	-	-	-	-	-	1	3	-	4	0.01	92.14	2
AR	*Stenothoe estacola*	-	-	-	-	1	-	-	-	-	-	-	-	3	-	4	0.01	92.15	2
CN	*Edwardsia* sp G MEC 1992	-	1	-	1	1	-	-	-	1	-	-	-	-	-	4	0.01	92.16	4
EC	*Lovenia cordiformis*	-	-	-	-	4	-	-	-	-	-	-	-	-	-	4	0.01	92.16	1
MO	*Crepidula norrisiarum*	-	-	-	-	-	-	-	-	-	-	-	3	-	1	4	0.01	92.18	2
MO	*Epitonium sawinae*	-	-	-	-	-	-	-	-	1	1	-	-	2	-	4	0.01	92.19	3
MO	*Kellia suborbicularis*	1	-	1	-	-	-	-	-	-	2	-	-	-	-	4	0.01	92.20	3
MO	*Kurtziella plumbea*	-	-	-	1	1	-	-	-	1	-	-	-	1	-	4	0.01	92.21	4
MO	*Odostomia* sp D MBC 1980	-	-	-	-	-	-	-	-	-	-	-	-	3	1	4	0.01	92.22	2
MO	*Rhamphidonta retifera*	-	-	-	-	-	-	-	-	-	-	-	2	1	1	4	0.01	92.24	3
MO	*Solen sicarius*	-	-	-	-	-	1	-	1	-	-	2	-	-		4	0.01	92.25	3
NE	*Micrura alaskensis*	-	1	2	-	1	-	-	-	-	-	-	-	-	-	4	0.01	92.26	3
NE	*Tetrastemma nigrifrons*	-	-	-	-	-	-	-	-	-	2	-	-	-	2	4	0.01	92.27	2
NE	*Tubulanus nothus*	-	-	-	-	-	-	-	-	-	1	-	2	1	-	4	0.01	92.28	3
PL	Cryptocelis occidentalis	-	-	-	4	-	-	-	-	-	-	-	-	-	-	4	0.01	92.29	1
SI	Sipuncula	1	2	-	-	-	-	-	-	-	-	-	-	-	1	4	0.01	92.31	3
AN	*Arabella iricolor*	-	-	-	2	-	-	-	-	-	-	-	-	-	1	3	0.01	92.31	2
AN	*Chaetozone armata*	-	-	-	-	-	-	-	-	1	-	-	-	2	-	3	0.01	92.32	2
AN	*Halosydna johnsoni*	-	-	-	-	-	-	-	-	-	-	-	1	2	-	3	0.01	92.33	2
AN	*Harmothoe* sp	-	2	-	-	-	-	-	-	-	-	-	-	-	1	3	0.01	92.34	2
AN	*Heterospio catalinensis*	1	-	-	-	-	-	-	-	-	2	-	-	-	-	3	0.01	92.35	2
AN	*Mooreonuphis stigmatis*	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3	0.01	92.36	1
AN	*Polydora limicola*	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	0.01	92.37	1
AN	*Scolelepis squamata*	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3	0.01	92.38	1
AN	*Scoloplos* sp	-	1	-	2	-	-	-	-	-	-	-	-	-	-	3	0.01	92.39	2
AR	*Blepharipoda occidentalis*	-	-	-	1	-	-	-	1	1	-	-	-	-	-	3	0.01	92.39	3
AR	*Ischyrocerus anguipes*	-	1	-	-	-	-	-	-	-	-	-	-	-	2	3	0.01	92.40	2
AR	*Joeropsis dubia*	-	-	-	-	-	-	-	-	1	-	-	-	1	1	3	0.01	92.41	3
AR	*Listriella melanica*	-	-	-	1	-	-	-	-	-	-	-	1	-	1	3	0.01	92.42	3
AR	Mysidacea	2	-	-	-	-	-	-	-	-	-	1	-	-	-	3	0.01	92.43	2
AR	*Nebalia daytoni*	-	-	-	-	-	-	-	-	-	1	-	-	-	2	3	0.01	92.44	2
AR	*Nebalia pugettensis* Cmplx	-	-	-	1	2	-	-	-	-	-	-	-	-	-	3	0.01	92.45	2
AR	*Neomysis kadiakensis*	-	-	-	-	-	-	-	-	1	-	-	2	-	-	3	0.01	92.46	2

Appendix G-5. (Cont.).

Phylum	Species	1978	1980	1986	1988	1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	Total	Percent Total	Cum. Percent	F.O.
		Year																	
AR	*Ogyrides* sp A Roney 1978	-	-	-	-	1	-	-	-	2	-	-	-	-	-	3	0.01	92.47	2
AR	*Parasterope hulingsi*	-	-	-	-	-	-	-	-	-	-	-	-	2	1	3	0.01	92.47	2
AR	*Photis bifurcata*	-	-	-	-	-	-	-	-	-	-	-	2	1	-	3	0.01	92.48	2
AR	*Postasterope barnesi*	-	-	-	-	1	-	-	-	-	2	-	-	-	-	3	0.01	92.49	2
AR	Pycnogonida	1	-	-	-	2	-	-	-	-	-	-	-	-	-	3	0.01	92.50	2
AR	*Xenoleberis californica*	1	2	-	-	-	-	-	-	-	-	-	-	-	-	3	0.01	92.51	2
CN	Edwardsiidae	-	1	1	-	1	-	-	-	-	-	-	-	-	-	3	0.01	92.52	3
CN	*Renilla kollikeri*	-	-	-	-	1	-	-	-	-	-	-	-	-	2	3	0.01	92.53	2
EC	Holothuroidea	-	-	-	-	-	-	-	-	-	-	-	-	3	-	3	0.01	92.53	1
MO	*Cadulus aberrans*	-	-	-	-	-	-	-	-	-	1	-	-	1	1	3	0.01	92.54	3
MO	*Donax gouldii*	-	1	-	-	-	-	-	-	-	-	-	-	2	-	3	0.01	92.55	2
MO	*Doto amyra*	-	-	-	-	-	-	-	-	-	-	-	-	3	-	3	0.01	92.55	1
MO	*Lyonsia californica*	-	-	-	-	-	-	-	-	-	-	-	1	2	-	3	0.01	92.56	2
MO	Mactridae	-	1	-	2	-	-	-	-	-	-	-	-	-	-	3	0.01	92.57	2
MO	*Modiolus rectus*	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3	0.01	92.58	1
MO	*Odostomia* sp	-	-	-	-	-	-	-	-	1	-	-	-	2	-	3	0.01	92.59	2
MO	*Saxidomus nuttalli*	-	-	-	1	-	-	-	-	-	1	-	-	1	-	3	0.01	92.60	3
MO	*Turbonilla* sp	-	3	-	-	-	-	-	-	-	-	-	-	-	-	3	0.01	92.61	1
NE	*Anopla* sp D SCAMIT 1995	-	-	-	-	-	-	-	-	-	-	3	-	-	-	3	0.01	92.62	1
PL	*Stylochoplana longipenis*	-	-	-	-	-	-	-	-	1	-	-	-	2	-	3	0.01	92.63	2
AN	*Amastigos acutus*	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2	0.01	92.63	1
AN	*Ancistrosyllis hamata*	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2	0.01	92.64	2
AN	*Aphelochaeta monilaris*	-	-	-	-	-	-	2	-	-	-	-	-	-	-	2	0.01	92.64	1
AN	*Aricidea (Aedicira) pacifica*	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2	0.01	92.65	1
AN	*Axiothella rubrocincta*	-	-	1	-	-	-	1	-	-	-	-	-	-	-	2	0.01	92.65	2
AN	*Carazziella* sp	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2	0.01	92.66	1
AN	*Chaetozone corona*	-	-	-	-	-	-	-	-	-	-	-	1	-	1	2	0.01	92.67	2
AN	*Chone minuta*	-	-	-	-	-	-	-	-	-	1	-	-	1	-	2	0.01	92.67	2
AN	*Chone* sp	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2	0.01	92.68	1
AN	*Eranno lagunae*	-	-	-	-	-	-	-	-	-	-	2	-	-	-	2	0.01	92.68	1
AN	*Eteone fauchaldi*	-	-	-	1	1	-	-	-	-	-	-	-	-	-	2	0.01	92.69	2
AN	Euclymeninae sp A of SCAMIT 1987	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2	0.01	92.70	1
AN	*Eusyllis blomstrandi*	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2	0.01	92.70	1
AN	*Glycinde polygnatha*	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2	0.01	92.71	1
AN	*Glycinde* sp	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2	0.01	92.71	1
AN	*Goniada brunnea*	-	1	-	-	-	-	-	-	-	-	-	1	-	-	2	0.01	92.72	2
AN	*Hydroides uncinatus*	-	-	-	-	-	-	-	-	-	2	-	-	-	-	2	0.01	92.73	1
AN	*Loimia* sp A SCAMIT 2001	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2	0.01	92.73	2
AN	*Micropodarke dubia*	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2	0.01	92.74	1
AN	*Nephtys californiensis*	-	-	-	1	-	-	-	-	1	-	-	-	-	-	2	0.01	92.74	2
AN	Nereididae	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2	0.01	92.75	2
AN	*Notomastus latescens*	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2	0.01	92.76	1
AN	*Ophelia assimilis*	-	-	-	-	-	2	-	-	-	-	-	-	-	-	2	0.01	92.76	1
AN	*Paleanotus bellis*	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2	0.01	92.77	1
AN	*Platynereis bicanalicalata*	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2	0.01	92.77	2
AN	*Poecilochaetus johnsoni*	1	-	-	-	-	-	-	-	-	-	-	-	-	1	2	0.01	92.78	2
AN	*Polydora nuchalis*	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2	0.01	92.78	1
AN	*Prionospio (Prionospio) heterobranchia*	-	-	-	-	-	1	-	-	-	-	-	1	-	-	2	0.01	92.78	2
AN	*Prionospio (Prionospio) jubata*	-	-	-	-	1	-	-	-	1	-	-	-	-	-	2	0.01	92.79	2
AN	*Scoletoma* sp	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	0.01	92.80	1
AN	*Sphaerodoropsis sphaerulifer*	-	-	-	-	-	-	-	-	-	2	-	-	-	-	2	0.01	92.80	1
AR	*Acuminodeutopus heteruropus*	-	-	-	-	-	-	-	-	1	1	-	-	-	-	2	0.01	92.81	2
AR	*Ammothea hilgendorfi*	-	-	-	-	-	2	-	-	-	-	-	-	-	-	2	0.01	92.81	1
AR	*Aoroides exilis*	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2	0.01	92.82	1
AR	Brachyura (Megalopa)	-	-	-	-	1	-	-	-	-	-	-	-	1	-	2	0.01	92.83	2
AR	*Haliophasma geminatum*	-	-	-	-	-	-	1	-	-	1	-	-	-	-	2	0.01	92.83	2
AR	*Heterocrypta occidentalis*	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2	0.01	92.84	1
AR	*Laticorophium baconi*	-	-	-	-	1	-	-	-	-	-	-	-	1	-	2	0.01	92.84	2
AR	*Lepidepecreum gurjanovae*	-	-	-	-	-	1	1	-	-	-	-	-	-	-	2	0.01	92.85	2
AR	*Mysidopsis intii*	-	-	-	-	-	-	-	-	-	1	-	-	1	-	2	0.01	92.86	2
AR	Oedicerotidae	-	-	-	-	-	2	-	-	-	-	-	-	-	-	2	0.01	92.86	1
AR	*Pachynus barnardi*	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2	0.01	92.87	1
AR	Peltidiidae	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2	0.01	92.87	2
AR	*Pinnixa franciscana*	-	-	-	2	-	-	-	-	-	-	-	-	-	-	2	0.01	92.88	1
AR	*Pinnixa longipes*	-	-	-	-	-	1	-	-	-	-	-	1	-	-	2	0.01	92.89	2
AR	Pinnotheridae	-	-	1	1	-	-	-	-	-	-	-	-	-	-	2	0.01	92.89	2
AR	*Zeuxo normani*	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2	0.01	92.90	1
EC	*Amphiura arcystata*	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	0.01	92.90	1
EH	*Arynchite californica*	-	-	-	2	-	-	-	-	-	-	-	-	-	-	2	0.01	92.91	1
MO	*Alia carinata*	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2	0.01	92.91	1
MO	*Emarcusia morroensis*	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.01	92.92	1
MO	*Epitonium* sp	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2	0.01	92.93	1
MO	*Facelinidae*	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	0.01	92.93	1

Appendix G-5. (Cont.).

Phylum	Species	Year 1978	1980	1986	1988	1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	Total	Percent Total	Cum. Percent	F.O.
MO	*Hiatella arctica*	-	-	-	1	-	-	-	-	-	-	-	-	1	-	2	0.01	92.94	2
MO	*Odostomia farella*	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.01	92.94	1
MO	*Parvilucina tenuisculpta*	-	1	-	-	-	-	-	-	-	1	-	-	-	-	2	0.01	92.95	2
MO	*Petricola* sp	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2	0.01	92.96	1
MO	*Philine bakeri*	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2	0.01	92.96	1
MO	*Tellina* sp B SCAMIT 1995	-	-	-	-	-	-	-	-	2	-	-	-	-	-	2	0.01	92.97	1
MO	*Vitrinella oldroydi*	-	-	1	-	-	-	-	-	-	1	-	-	-	-	2	0.01	92.97	2
MO	*Volvulella cylindrica*	-	-	1	1	-	-	-	-	-	-	-	-	-	-	2	0.01	92.98	2
NE	*Cerebratulus* sp	-	-	-	-	-	-	-	-	-	-	-	1	-	1	2	0.01	92.99	2
NE	*Tubulanus frenatus*	-	-	-	-	-	-	-	-	-	2	-	-	-	-	2	0.01	92.99	1
NE	*Tubulanus* sp	-	-	-	-	-	-	-	-	-	-	2	-	-	-	2	0.01	93.00	1
PL	*Kaburakia excelsa*	-	-	-	2	-	-	-	-	-	-	-	-	-	-	2	0.01	93.00	1
PL	*Notoplana* sp	-	-	-	-	-	-	-	-	1	-	-	-	-	1	2	0.01	93.01	2
PL	*Pseudoceros* sp	-	-	-	-	-	-	-	-	-	-	1	-	-	1	2	0.01	93.02	2
AN	Amphinomidae	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	0.00	93.02	1
AN	*Ancistrosyllis groenlandica*	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.02	1
AN	*Aricidea (Allia)* sp A SCAMIT 1996	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.02	1
AN	*Caulleriella alata*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.03	1
AN	*Caulleriella bioculata*	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	0.00	93.03	1
AN	*Caulleriella* sp	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0.00	93.03	1
AN	*Decamastus gracilis*	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.04	1
AN	*Demonax* sp 1 Fitzhugh	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.04	1
AN	*Diopatra* sp	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00	93.04	1
AN	*Dipolydora* sp	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00	93.04	1
AN	Dorvilleidae	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.05	1
AN	*Drilonereis* sp	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.05	1
AN	*Ephesiella brevicapitis*	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0.00	93.05	1
AN	*Eteone brigitteae*	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.06	1
AN	*Eteone californica*	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	0.00	93.06	1
AN	*Eteone dilatae*	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.06	1
AN	*Eteone lighti*	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	0.00	93.07	1
AN	*Eulalia quadrioculata*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.07	1
AN	*Eusyllis* sp	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0.00	93.07	1
AN	*Exogone dwisula*	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00	93.07	1
AN	*Flabelligeridae*	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	0.00	93.08	1
AN	*Gyptis* sp	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.08	1
AN	*Laonice cirrata*	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	0.00	93.08	1
AN	*Lumbrineris cruzensis*	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.09	1
AN	*Lumbrineris japonica*	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.09	1
AN	*Magelona hartmanae*	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.09	1
AN	*Malmgreniella scriptoria*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.09	1
AN	*Megalomma pigmentum*	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0.00	93.10	1
AN	*Naineris dendritica*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.10	1
AN	*Nereis* sp	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.10	1
AN	*Nicomache* sp	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	0.00	93.11	1
AN	*Notocirrus californiensis*	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0.00	93.11	1
AN	*Notomastus hemipodus*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.11	1
AN	*Notomastus* sp A SCAMIT 2001	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00	93.12	1
AN	Oenonidae	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.12	1
AN	Oligochaeta	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00	93.12	1
AN	*Ophiodromus pugettensis*	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0.00	93.12	1
AN	*Paranaitis polynoides*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.13	1
AN	*Pareurythoe californica*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.13	1
AN	*Pherusa neopapillata*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.13	1
AN	*Phyllochaetopterus prolifica*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.14	1
AN	*Phyllodoce pettiboneae*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.14	1
AN	*Polycirrus californicus*	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0.00	93.14	1
AN	*Polycirrus* sp 1 Banse 1980	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.15	1
AN	*Polycirrus* sp A SCAMIT 1995	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00	93.15	1
AN	Polynoidae	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.15	1
AN	*Rhynchospio glutaea*	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	0.00	93.15	1
AN	*Schistocomus* sp A SCAMIT 1987	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.16	1
AN	*Scolelepis tridentata*	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00	93.16	1
AN	*Scoloplos acmeceps*	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00	93.16	1
AN	Sigalionidae	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	0.00	93.17	1
AN	Sphaerodoridae	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00	93.17	1
AN	Spionidae	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.17	1
AN	*Spiophanes* sp	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.17	1
AN	*Sthenelais* sp	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.18	1
AN	*Syllis (Typosyllis)* sp	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.18	1
AN	Terebellidae	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	0.00	93.18	1
AN	*Travisia gigas*	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.19	1
AN	*Ysideria hastata*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.19	1

Appendix G-5. (Cont.).

Phylum	Species	Year 1978	1980	1986	1988	1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	Total	Percent Total	Cum. Percent	F.O.
AR	*Acetabulastoma californica*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.19	1
AR	*Alpheus clamator*	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0.00	93.20	1
AR	*Ampelisca cristata cristata*	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.20	1
AR	Ampeliscidae	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	0.00	93.20	1
AR	*Araphura cuspirostris*	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	0.00	93.20	1
AR	Arthropoda	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	0.00	93.21	1
AR	*Balanus nubilus*	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.21	1
AR	*Cancer gracilis*	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.21	1
AR	*Cancer jordani*	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	0.00	93.22	1
AR	*Cancer productus*	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	0.00	93.22	1
AR	Cumacea	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.22	1
AR	*Cumella* sp	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00	93.22	1
AR	*Cyclaspis* sp B SCAMIT 1989	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	0.00	93.23	1
AR	*Cyprideis stewarti*	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00	93.23	1
AR	*Diastylis* sp	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	0.00	93.23	1
AR	*Emerita analoga*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.24	1
AR	*Eobrolgus spinosus*	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.24	1
AR	*Eohaustorius* sp	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.24	1
AR	Eusiridae	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.25	1
AR	*Exacanthomysis davisi*	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.25	1
AR	Flabellifera	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	0.00	93.25	1
AR	*Gnathia crenulatifrons*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.25	1
AR	Harpacticoida	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.26	1
AR	*Heteroserolis carinata*	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.26	1
AR	*Listriella diffusa*	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.26	1
AR	*Listriella eriopisa*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.27	1
AR	Lysianassidae	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	0.00	93.27	1
AR	Natantia	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	0.00	93.27	1
AR	*Opisthopus transversus*	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.28	1
AR	Ostracoda	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.28	1
AR	Paguridae	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	0.00	93.28	1
AR	*Photis* sp A MBC 1972	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	0.00	93.28	1
AR	*Pinnixa tubicola*	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.29	1
AR	*Portunus xantusii*	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.29	1
CN	Pennatulacea	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00	93.29	1
CO	*Branchiostoma californiensis*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.30	1
EC	*Amphipholus squamata*	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.30	1
EC	*Astropecten verrilli*	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.30	1
EC	*Cucumaria piperata*	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	0.00	93.30	1
EC	*Ophiothrix spiculata*	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00	93.30	1
EC	*Pentamera populifera*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.31	1
EP	*Antropora tincta*	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00	93.31	1
EP	*Bowerbankia gracilis*	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00	93.31	1
EP	*Caulibugula ciliata*	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.32	1
EP	*Celleporella hyalina*	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00	93.32	1
EP	*Cryptoarachnidium argilla*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.32	1
EP	*Farrella elongata*	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.33	1
MO	*Acteocina harpa*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.33	1
MO	*Acteocina inculta*	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00	93.33	1
MO	*Aglaja ocelligera*	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	0.00	93.33	1
MO	*Amiantis callosa*	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	0.00	93.34	1
MO	*Caecum crebricinctum*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.34	1
MO	Chamidae	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.34	1
MO	*Chione undatella*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.35	1
MO	Gastropoda	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.35	1
MO	*Halistylis pupoideus*	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00	93.35	1
MO	*Hermissenda crassicornis*	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.36	1
MO	*Lithophaga plumula*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.36	1
MO	*Lucinoma annulata*	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.36	1
MO	*Macoma carlottensis*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.36	1
MO	*Modiolus neglectus*	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.37	1
MO	*Nuculana taphria*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.37	1
MO	*Odostomia columbiana*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.37	1
MO	*Ophiodermella cancellata*	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.38	1
MO	*Polinices* sp	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	0.00	93.38	1
MO	*Polygireulima rutila*	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.38	1
MO	Pseudodoridoidae	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.38	1
MO	*Rochefortia compressa*	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	0.00	93.39	1
MO	*Simomactra planulata*	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0.00	93.39	1
MO	*Sphenia fragilis*	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0.00	93.39	1
MO	*Sphenia luticola*	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00	93.40	1
MO	*Tellina nuculoides*	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.40	1
MO	*Turbonilla santarosana*	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	0.00	93.40	1

Appendix G-5. (Cont.).

Phylum	Species	1978	1980	1986	1988	1990	1991	1992	1993	1994	1997	1998	1999	2000	2001	Total	Percent Total	Cum. Percent	F.O.
		Year																	
MO	*Turbonilla* sp L MBC 1975	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	0.00	93.41	1
MO	*Yoldia seminuda*	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00	93.41	1
NE	Hoplonemertea sp A Paquette 1988	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.41	1
NE	*Micrura* sp	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.41	1
NE	*Tetrastemma signifer*	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	93.42	1
NE	*Tetrastemma* sp	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	0.00	93.42	1
SI	*Sipunculus nudus*	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	0.00	93.42	1
Number of individuals		993	1267	576	1717	878	1238	312	244	933	10393	781	3373	7829	3311	33845			
Number of species		109	144	92	140	129	100	61	60	149	124	91	162	206	174	517			
Diversity (H')		3.37	3.92	3.17	3.41	4.00	2.91	3.51	3.52	3.97	0.99	3.11	3.45	2.94	3.28	3.61			
Number of stations/reps		7/4	7/4	7/4*	7/4	6/4	6/4	6/4	6/4	6/4	6/4	3/4	6/4	6/4	6/4				
Total biomass		NR	NR	28.0	1.43	75.3	2.71	21.4	16.1	12.7	7.96	6.02	78.9	437	16.6				

NR = Not Reported
F.O. = Frequency of Occurrence
Note: 0.00 = <0.005
* = Samples screened on 1.0mm screen, all other years on 0.5mm screen.

APPENDIX H

Fish and macroinvertebrate heat treatment and normal operation data

Appendix H-1. Master species list of fish and macroinvertebrate species impinged during heat treatments and normal operations. Reliant Energy Ormond Beach generating station NPDES, 2001.

PHYLUM / Class / Family / Species	Common Name
CNIDARIA	
Hydrozoa	
Hydroida	
Polyorchis penicillata	red jellyfish
MOLLUSCA	
Gastropoda	
Fissurellidae	
Megathura crenulata	giant keyhole limpet
Cephalopoda	
Loliginidae	
Loligo opalescens	California market squid
Octopodidae	
Octopus bimaculoides	California two-spot octopus
ARTHROPODA	
Malacostraca	
Hippolytidae	
Lysmata californica	red rock shrimp
Crangonidae	
Crangon nigromaculata	blackspotted bay shrimp
Palinuridae	
Farfantepenaeus (=Penaeus) californiensis	yellowleg shrimp
Panulirus interruptus	California spiny lobster
Majidae	
Loxorhynchus crispatus	masking crab
Loxorhynchus grandis	sheep crab
Cancridae	
Cancer antennarius	Pacific rock crab
Cancer gracilis	graceful rock crab
Portunidae	
Portunus xantusii	Xantus swimming crab
Grapsidae	
Pachygrapsus crassipes	striped shore crab
ECHINODERMATA	
Asteroidea	
Asteriidae	
Pisaster sp	sea star, unid.
Echinoidea	
Strongylocentrotidae	
Strongylocentrotus purpuratus	purple sea urchin
Holothuroidea	
Stichipodidae	
Parastichopus sp	sea cucumber, unid.
Caudinidae	
Caudina arenicola	sweetpotato sea cucumber
CHORDATA	
Thaliacea	
Salpidae	
Thetys vagina	common salp
VERTEBRATA	
Elasmobranchiomorphi (= Chondrichthyes, Elasmobranchii)	
Carcharhinidae	
Mustelus sp	smoothhound, unid.
Triakis semifasciata	leopard shark
Rhinobatidae	
Platyrhinoidis triseriata	thornback
Torpedinidae	
Torpedo californica	Pacific electric ray
Urolophidae (Dasyatidae, in part)	
Urolophus halleri	round stingray
Myliobatidae	
Myliobatis californica	bat ray
VERTEBRATA (cont.).	
Osteichthyes (=Actinopterygii)	
Clupeidae	
Sardinops sagax	Pacific sardine
Engraulidae	
Engraulis mordax	northern anchovy
Synodontidae	
Synodus lucioceps	California lizardfish
Ophidiidae	
Ophidion scrippsae	basketweave cusk-eel
Atherinidae	
Atherinops affinis	topsmelt
Batrachoididae	
Porichthys myriaster	speckledfin midshipman
Porichthys notatus	planinfin midshipman
Atherinidae	
Leuresthes tenuis	California grunion
Syngnathidae	
Sygnathus sp	pipefish, unidentified
Scorpaenidae	
Scorpaena guttata	California scorpionfish
Sebastes auriculatus	brown rockfish
Hexagrammidae	
Ophiodon elongatus	lingcod
Cottidae	
Leptocottus armatus	Pacific staghorn sculpin
Scorpaenichthys marmoratus	cabezon
Serranidae	
Paralabrax clathratus	kelp bass
Paralabrax nebulifer	barred sand bass
Sciaenidae	
Cheilotrema saturnum	black croaker
Genyonemus lineatus	white croaker
Menticirrhus undulatus	California corbina
Seriphus politus	queenfish
Embiotocidae	
Amphistichus argenteus	barred surfperch
Brachyistius frenatus	kelp perch
Cymatogaster aggregata	shiner perch
Embiotoca jacksoni	black perch
Embiotoca lateralis	striped seaperch
Hyperprosopon argenteum	walleye surfperch
Phanerodon furcatus	white seaperch
Rhacochilus toxotes	rubberlip seaperch
Rhacochilus vacca	pile perch
Pomacentridae	
Chromis punctipinnis	blacksmith
Labridae	
Halichoeres semicinctus	rock wrasse
Labridae	
Oxyjulis californica	senorita
Haemulidae	
Xenistius californiensis	salema
Hexagrammidae	
Oxylebius pictus	painted greenling
Pleuronectidae	
Pleuronichthys verticalis	hornyhead turbot
Pleuronichthys ritteri	spotted turbot
Scombridae	
Scomber japonicus	chub mackerel
Stromateidae	
Peprilus simillimus	Pacific pompano
Bothidae	
Citharichthys stigmaeus	speckled sanddab
Paralichthys californicus	California halibut
Soleidae	
Symphurus atricauda	California tonguefish

Appendix H-2. Abundance of fish impinged during heat treatments and normal operations between 1 October 2000 and 30 September 2001. Reliant Energy Ormond Beach generating station NPDES, 2001.

Species	Heat Treatment Abund.	Monitored Normal Operations Abund.	Extrapolated Normal Operations* Abund.	Total Abundance	Percent Total
Peprilus simillimus	67	93	3283	3350	21.50
Seriphus politus	1523	50	1740	3263	20.94
Citharichthys stigmaeus	-	38	1330	1330	8.53
Engraulis mordax	518	21	626	1144	7.34
Atherinops affinis	123	26	851	974	6.25
Myliobatis californica	2	21	738	740	4.75
Hyperprosopon argenteum	611	-	-	611	3.92
Platyrhinoidis triseriata	2	17	563	565	3.63
Cymatogaster aggregata	94	15	448	542	3.48
Lepotocottus armatus	1	13	462	463	2.97
Sardinops sagax	30	9	265	295	1.89
Paralabrax nebulifer	202	1	42	244	1.57
Pleuronichthys verticalis	2	7	217	219	1.41
Pleuronichthys ritteri	1	6	212	213	1.37
Porichthys myriaster	11	7	201	212	1.36
Ophidion scrippsae	-	6	207	207	1.33
Torpedo californica	1	6	177	178	1.14
Synodus lucioceps	1	5	142	143	0.92
Leuresthes tenuis	4	4	123	127	0.81
Amphistichus argenteus	47	2	71	118	0.76
Genyonemus lineatus	1	3	100	101	0.65
Syngathus sp	-	2	73	73	0.47
Menticirrhus undulatus	-	2	71	71	0.46
Triakis semifasciata	-	2	66	66	0.42
Paralichthys californicus	-	2	62	62	0.40
Phanerodon furcatus	6	1	30	36	0.23
Symphurus atricauda	-	1	36	36	0.23
Urolophus halleri	-	1	36	36	0.23
Scorpaena guttata	2	1	31	33	0.21
Sebastes auriculatus	33	-	-	33	0.21
Scorpaenichthys marmoratus	24	-	-	24	0.15
Rhacochilus toxotes	17	-	-	17	0.11
Oxyjulis californica	14	-	-	14	0.09
Embiotoca jacksoni	11	-	-	11	0.07
Paralabrax clathratus	8	-	-	8	0.05
Cheilotrema saturnum	4	-	-	4	0.03
Scomber japonicus	4	-	-	4	0.03
Chromis punctipinnis	3	-	-	3	0.02
Embiotoca lateralis	3	-	-	3	0.02
Halichoeres semicinctus	2	-	-	2	0.01
Rhacochilus vacca	2	-	-	2	0.01
Brachyistius frenatus	1	-	-	1	0.01
Mustelus sp	1	-	-	1	0.01
Ophiodon elongatus	1	-	-	1	0.01
Oxylebius pictus	1	-	-	1	0.01
Porichthys notatus	1	-	-	1	0.01
Xenistius californiensis	1	-	-	1	0.01
Survey totals	3380	362	12203	15583	
Number of species	39	28	28	47	

* Extrapolations based on flow during month sampled divided by flow on date sampled, multiplied by abundance on sampling date: 12 days sampled during year, totaling 3.23% of the annual circulation through plant.

Appendix H-3. Biomass (kg) of fish impinged during heat treatments and normal operations between 1 October 2000 and 30 September 2001. Reliant Energy Ormond Beach generating station NPDES, 2001.

Species	Heat Treatment Biomass	Monitored Normal Operations Biomass	Extrapolated Normal Operations* Biomass	Total Biomass	Percent Total
Torpedo californica	4.500	34.584	1011.798	1016.298	37.81
Myliobatis californica	1.329	21.325	759.673	761.002	28.31
Platyrhinoidis triseriata	1.072	8.500	274.631	275.703	10.26
Paralabrax nebulifer	104.002	0.702	29.145	133.147	4.95
Peprillus simillimus	2.689	2.575	90.923	93.612	3.48
Engraulis mordax	12.207	1.770	50.501	62.708	2.33
Seriphus politus	30.403	0.546	18.397	48.800	1.82
Atherinops affinis	12.912	0.792	27.171	40.083	1.49
Hyperprosopon argenteum	21.827	-	-	21.827	0.81
Porichthys myriaster	1.495	0.696	19.832	21.327	0.79
Triakis semifasciata	-	0.594	20.877	20.877	0.78
Lepotocottus armatus	0.027	0.561	20.021	20.048	0.75
Sardinops sagax	2.364	0.557	16.415	18.779	0.70
Urolophus halleri	-	0.500	17.753	17.753	0.66
Paralichthys californicus	-	0.600	16.527	16.527	0.61
Menticirrhus undulatus	-	0.401	14.238	14.238	0.53
Pleuronichthys verticalis	0.173	0.429	13.658	13.831	0.51
Ophidion scrippsae	-	0.340	11.562	11.562	0.43
Scorpaenichthys marmoratus	11.434	-	-	11.434	0.43
Pleuronichthys ritteri	0.153	0.252	8.743	8.896	0.33
Citharichthys stigmaeus	-	0.252	8.845	8.845	0.33
Synodus lucioceps	0.009	0.291	8.193	8.202	0.31
Sebastes auriculatus	7.402	-	-	7.402	0.28
Genyonemus lineatus	0.220	0.211	7.013	7.233	0.27
Cymatogaster aggregata	1.972	0.086	2.566	4.538	0.17
Amphistichus argenteus	0.605	0.082	2.911	3.516	0.13
Rhacochilus toxotes	2.376	-	-	2.376	0.09
Scorpaena guttata	0.284	0.064	1.962	2.246	0.08
Leuresthes tenuis	0.104	0.053	1.625	1.729	0.06
Paralabrax clathratus	1.721	-	-	1.721	0.06
Embiotoca jacksoni	1.683	-	-	1.683	0.06
Oxyjulis californica	1.682	-	-	1.682	0.06
Mustelus sp	1.629	-	-	1.629	0.06
Scomber japonicus	1.473	-	-	1.473	0.05
Symphurus atricauda	-	0.029	1.030	1.030	0.04
Chromis punctipinnis	1.007	-	-	1.007	0.04
Ophiodon elongatus	0.705	-	-	0.705	0.03
Halichoeres semicinctus	0.660	-	-	0.660	0.02
Phanerodon furcatus	0.197	0.008	0.239	0.436	0.02
Cheilotrema saturnum	0.249	-	-	0.249	0.01
Rhacochilus vacca	0.235	-	-	0.235	0.01
Porichthys notatus	0.225	-	-	0.225	0.01
Embiotoca lateralis	0.161	-	-	0.161	0.01
Syngathus sp	-	0.004	0.146	0.146	0.01
Brachyistius frenatus	0.083	-	-	0.083	0.00
Oxylebius pictus	0.060	-	-	0.060	0.00
Xenistius californiensis	0.010	-	-	0.010	0.00
Survey totals	231.339	76.804	2456.395	2687.734	

Note: 0.00 = < 0.005

* Extrapolations based on flow during month sampled divided by flow on date sampled, multiplied by biomass on sampling date: 12 days sampled during year, totaling 3.23% of the annual circulation through plant.

Appendix H-4. Abundance of fish impinged during heat treatments. Reliant Energy Ormond Beach generating station NPDES, 2001.

Species	2000			2001						Total	Percent	Cum.
	28-Oct	4-Nov	30-Dec	22-Feb	2-May	27-May	21-Jun	18-Aug	22-Sep		Total	Percent
Seriphus politus	889	149	125	73	31	2	118	75	61	1523	45.1	45.1
Hyperprosopon argenteum	332	108	164	7	-	-	-	-	-	611	18.1	63.1
Engraulis mordax	8	2	60	-	-	-	151	288	9	518	15.3	78.5
Paralabrax nebulifer	1	1	-	45	22	10	31	65	27	202	6.0	84.4
Atherinops affinis	115	-	7	1	-	-	-	-	-	123	3.6	88.1
Cymatogaster aggregata	71	-	-	-	-	-	-	19	4	94	2.8	90.9
Peprillus simillimus	2	-	-	-	1	-	25	37	2	67	2.0	92.8
Amphistichus argenteus	-	1	-	-	-	-	3	-	43	47	1.4	94.2
Sebastes auriculatus	6	1	1	-	2	2	6	10	5	33	1.0	95.2
Sardinops sagax	6	1	20	-	-	-	2	-	1	30	0.9	96.1
Scorpaenichthys marmora	-	-	-	-	1	1	11	7	4	24	0.7	96.8
Rhacochilus toxotes	8	3	6	-	-	-	-	-	-	17	0.5	97.3
Oxyjulis californica	2	-	-	3	-	-	1	4	4	14	0.4	97.7
Embiotoca jacksoni	1	-	1	-	-	6	2	-	1	11	0.3	98.0
Porichthys myriaster	1	-	1	-	1	-	8	-	-	11	0.3	98.4
Paralabrax clathratus	4	-	-	-	-	-	-	4	-	8	0.2	98.6
Phanerodon furcatus	5	-	-	-	-	-	-	1	-	6	0.2	98.8
Cheilotrema saturnum	1	3	-	-	-	-	-	-	-	4	0.1	98.9
Leuresthes tenuis	-	-	2	1	1	-	-	-	-	4	0.1	99.0
Scomber japonicus	1	-	-	-	-	-	-	-	3	4	0.1	99.1
Chromis punctipinnis	-	-	-	-	1	-	1	-	1	3	0.1	99.2
Embiotoca lateralis	-	-	-	-	-	-	3	-	-	3	0.1	99.3
Halichoeres semicinctus	-	-	-	-	1	-	-	-	1	2	0.1	99.4
Myliobatis californica	-	-	-	-	-	-	2	-	-	2	0.1	99.4
Platyrhinoidis triseriata	-	-	-	1	-	-	-	1	-	2	0.1	99.5
Pleuronichthys verticalis	-	-	-	-	-	-	2	-	-	2	0.1	99.6
Rhacochilus vacca	-	-	-	-	-	2	-	-	-	2	0.1	99.6
Scorpaena guttata	1	-	-	-	-	-	-	1	-	2	0.1	99.7
Brachyistius frenatus	-	-	-	1	-	-	-	-	-	1	0.0	99.7
Genyonemus lineatus	-	-	-	-	-	-	-	-	1	1	0.0	99.7
Lepotocottus armatus	-	-	1	-	-	-	-	-	-	1	0.0	99.8
Mustelus sp	-	-	-	-	-	-	1	-	-	1	0.0	99.8
Ophiodon elongatus	-	-	-	-	-	-	-	1	-	1	0.0	99.8
Oxylebius pictus	-	-	-	-	-	-	-	1	-	1	0.0	99.9
Pleuronichthys ritteri	-	1	-	-	-	-	-	-	-	1	0.0	99.9
Porichthys notatus	-	-	-	-	1	-	-	-	-	1	0.0	99.9
Synodus lucioceps	-	-	-	-	-	-	1	-	-	1	0.0	99.9
Torpedo californica	-	-	-	-	-	-	1	-	-	1	0.0	100.0
Xenistius californiensis	-	-	-	1	-	-	-	-	-	1	0.0	100.0
Number of individuals	1454	270	388	133	62	23	369	514	167	3380		
Number of species	18	10	11	9	10	6	18	14	15	39		

Note: 0.0 = < 0.05

Appendix H-5. Biomass (kg) of fish impinged during heat treatments. Reliant Energy Ormond Beach generating station NPDES, 2001.

	2000			2001							Percent	Cum.
Species	28-Oct	4-Nov	30-Dec	22-Feb	2-May	27-May	21-Jun	18-Aug	22-Sep	Total	Total	Percent
Paralabrax nebulifer	0.372	0.553	-	26.325	18.620	4.007	15.692	30.912	7.521	104.002	45.0	45.0
Seriphus politus	11.232	5.178	4.100	1.942	0.991	0.164	3.010	1.857	1.929	30.403	13.1	58.1
Hyperprosopon argenteum	12.069	3.254	6.177	0.327	-	-	-	-	-	21.827	9.4	67.5
Atherinops affinis	12.574	-	0.298	0.040	-	-	-	-	-	12.912	5.6	73.1
Engraulis mordax	0.086	0.008	1.109	-	-	-	6.139	4.713	0.152	12.207	5.3	78.4
Scorpaenichthys marmora	-	-	-	-	0.416	0.323	5.695	3.779	1.221	11.434	4.9	83.3
Sebastes auriculatus	1.066	0.251	0.069	-	0.221	0.910	1.813	2.062	1.010	7.402	3.2	86.5
Torpedo californica	-	-	-	-	-	-	4.500	-	-	4.500	1.9	88.5
Peprilus simillimus	0.088	-	-	-	0.034	-	0.997	1.558	0.012	2.689	1.2	89.6
Rhacochilus toxotes	1.606	0.170	0.600	-	-	-	-	-	-	2.376	1.0	90.7
Sardinops sagax	0.421	0.054	1.499	-	-	-	0.110	-	0.280	2.364	1.0	91.7
Cymatogaster aggregata	1.316	-	-	-	-	-	-	0.585	0.071	1.972	0.9	92.5
Paralabrax clathratus	0.531	-	-	-	-	-	-	1.190	-	1.721	0.7	93.3
Embiotoca jacksoni	0.076	-	0.100	-	-	1.215	0.167	-	0.125	1.683	0.7	94.0
Oxyjulis californica	0.181	-	-	0.297	-	-	0.060	0.588	0.556	1.682	0.7	94.7
Mustelus sp	-	-	-	-	-	-	1.629	-	-	1.629	0.7	95.4
Porichthys myriaster	0.241	-	0.696	-	0.365	-	0.193	-	-	1.495	0.6	96.1
Scomber japonicus	0.090	-	-	-	-	-	-	-	1.383	1.473	0.6	96.7
Myliobatis californica	-	-	-	-	-	-	1.329	-	-	1.329	0.6	97.3
Platyrhinoidis triseriata	-	-	-	0.316	-	-	-	0.756	-	1.072	0.5	97.8
Chromis punctipinnis	-	-	-	-	0.369	-	0.151	-	0.487	1.007	0.4	98.2
Ophiodon elongatus	-	-	-	-	-	-	-	0.705	-	0.705	0.3	98.5
Halichoeres semicinctus	-	-	-	-	0.242	-	-	-	0.418	0.660	0.3	98.8
Amphistichus argenteus	-	0.043	-	-	-	-	0.170	-	0.392	0.605	0.3	99.1
Scorpaena guttata	0.073	-	-	-	-	-	-	0.211	-	0.284	0.1	99.2
Cheilotrema saturnum	0.026	0.223	-	-	-	-	-	-	-	0.249	0.1	99.3
Rhacochilus vacca	-	-	-	-	-	0.235	-	-	-	0.235	0.1	99.4
Porichthys notatus	-	-	-	-	0.225	-	-	-	-	0.225	0.1	99.5
Genyonemus lineatus	-	-	-	-	-	-	-	-	0.220	0.220	0.1	99.6
Phanerodon furcatus	0.116	-	-	-	-	-	-	0.081	-	0.197	0.1	99.7
Pleuronichthys verticalis	-	-	-	-	-	-	0.173	-	-	0.173	0.1	99.7
Embiotoca lateralis	-	-	-	-	-	-	0.161	-	-	0.161	0.1	99.8
Pleuronichthys ritteri	-	0.153	-	-	-	-	-	-	-	0.153	0.1	99.9
Leuresthes tenuis	-	-	0.062	0.015	0.027	-	-	-	-	0.104	0.0	99.9
Brachyistius frenatus	-	-	-	0.083	-	-	-	-	-	0.083	0.0	100.0
Oxylebius pictus	-	-	-	-	-	-	-	0.060	-	0.060	0.0	100.0
Lepotocottus armatus	-	-	0.027	-	-	-	-	-	-	0.027	0.0	100.0
Xenistius californiensis	-	-	-	0.010	-	-	-	-	-	0.010	0.0	100.0
Synodus lucioceps	-	-	-	-	-	-	0.009	-	-	0.009	0.0	100.0
Biomass (kg)	42.164	9.887	14.737	29.355	21.510	6.854	41.998	49.057	15.777	231.339		

Note: 0.0 = < 0.05

Appendix H-6. Abundance of fish impinged during normal operation by month. Reliant Energy Ormond Beach generating station NPDES, 2001.

	2000			2001										Percent	Cum.
Species	24-Oct	8-Nov	28-Dec	18-Jan	22-Feb	7-Mar	12-Apr	15-May	13-Jun	17-Jul	15-Aug	13-Sep	Total	Total	Percent
Peprillus simillimus	-	-	-	-	-	89	4	-	-	-	-	-	93	25.7	25.7
Seriphus politus	6	8	-	8	7	14	2	-	-	-	-	5	50	13.8	39.5
Citharichthys stigmaeus	-	-	-	2	-	35	-	-	-	1	-	-	38	10.5	50.0
Atherinops affinis	2	1	-	-	-	7	16	-	-	-	-	-	26	7.2	57.2
Engraulis mordax	-	-	-	1	-	4	-	6	9	1	-	-	21	5.8	63.0
Myliobatis californica	-	1	-	-	1	17	1	-	1	-	-	-	21	5.8	68.8
Platyrhinoidis triseriata	-	-	-	-	1	8	4	2	1	-	-	1	17	4.7	73.5
Cymatogaster aggregata	-	-	-	-	-	-	-	-	-	-	-	15	15	4.1	77.6
Leptocottus armatus	2	-	-	-	-	10	-	-	-	-	-	1	13	3.6	81.2
Sardinops sagax	-	-	-	7	-	-	-	-	-	-	-	2	9	2.5	83.7
Pleuronichthys verticalis	1	-	-	-	-	-	-	-	1	-	1	4	7	1.9	85.6
Porichthys myriaster	-	-	-	-	-	-	-	1	1	3	-	2	7	1.9	87.6
Ophidion scrippsae	-	-	-	2	1	3	-	-	-	-	-	-	6	1.7	89.2
Pleuronichthys ritteri	-	-	-	-	1	4	-	1	-	-	-	-	6	1.7	90.9
Torpedo californica	-	1	1	1	-	-	-	-	1	1	-	1	6	1.7	92.5
Synodus lucioceps	-	-	-	-	-	-	-	-	-	4	-	1	5	1.4	93.9
Leuresthes tenuis	-	-	-	-	-	-	4	-	-	-	-	-	4	1.1	95.0
Genyonemus lineatus	-	-	-	1	-	2	-	-	-	-	-	-	3	0.8	95.9
Amphistichus argenteus	-	-	-	-	-	2	-	-	-	-	-	-	2	0.6	96.4
Menticirrhus undulatus	-	-	-	-	-	2	-	-	-	-	-	-	2	0.6	97.0
Paralichthys californicus	-	-	1	-	-	1	-	-	-	-	-	-	2	0.6	97.5
Syngathus sp	1	1	-	-	-	-	-	-	-	-	-	-	2	0.6	98.1
Triakis semifasciata	-	-	-	-	-	1	1	-	-	-	-	-	2	0.6	98.6
Paralabrax nebulifer	-	-	-	-	1	-	-	-	-	-	-	-	1	0.3	98.9
Phanerodon furcatus	-	-	-	-	-	-	-	-	-	-	-	1	1	0.3	99.2
Scorpaena guttata	-	-	-	-	-	-	1	-	-	-	-	-	1	0.3	99.4
Symphurus atricauda	-	-	-	-	-	1	-	-	-	-	-	-	1	0.3	99.7
Urolophus halleri	-	-	-	-	-	1	-	-	-	-	-	-	1	0.3	100.0
Number of individuals	12	12	2	22	12	201	33	10	14	10	1	33	362		
Number of species	5	5	2	7	6	17	8	4	6	5	1	10	28		

Appendix H-7. Biomass (kg) of fish impinged during normal operation by month. Reliant Energy Ormond Beach generating station NPDES, 2001.

	2000			2001										Percent	Cum.
Species	24-Oct	8-Nov	28-Dec	18-Jan	22-Feb	7-Mar	12-Apr	15-May	13-Jun	17-Jul	15-Aug	13-Sep	Total	Total	Percent
Torpedo californica	-	4.427	5.600	6.600	-	-	-	-	4.472	7.685	-	5.800	34.584	45.0	45.0
Myliobatis californica	-	0.672	-	-	2.712	16.000	0.375	-	1.566	-	-	-	21.325	27.8	72.8
Platyrhinoidis triseriata	-	-	-	-	0.514	2.835	2.420	1.994	0.287	-	-	0.450	8.500	11.1	83.9
Peprillus simillimus	-	-	-	-	-	2.471	0.104	-	-	-	-	-	2.575	3.4	87.2
Engraulis mordax	-	-	-	0.018	-	0.031	-	0.072	1.630	0.019	-	-	1.770	2.3	89.5
Atherinops affinis	0.215	0.025	-	-	-	0.219	0.333	-	-	-	-	-	0.792	1.0	90.5
Paralabrax nebulifer	-	-	-	-	0.702	-	-	-	-	-	-	-	0.702	0.9	91.5
Porichthys myriaster	-	-	-	-	-	-	-	0.322	0.042	0.257	-	0.075	0.696	0.9	92.4
Paralichthys californicus	-	-	0.552	-	-	0.048	-	-	-	-	-	-	0.600	0.8	93.2
Triakis semifasciata	-	-	-	-	-	0.550	0.044	-	-	-	-	-	0.594	0.8	93.9
Leptocottus armatus	0.058	-	-	-	-	0.488	-	-	-	-	-	0.015	0.561	0.7	94.7
Sardinops sagax	-	-	-	0.436	-	-	-	-	-	-	-	0.121	0.557	0.7	95.4
Seriphus politus	0.045	0.019	-	0.109	0.033	0.220	0.048	-	-	-	-	0.072	0.546	0.7	96.1
Urolophus halleri	-	-	-	-	-	0.500	-	-	-	-	-	-	0.500	0.7	96.7
Pleuronichthys verticalis	0.132	-	-	-	-	-	-	-	0.221	-	0.003	0.073	0.429	0.6	97.3
Menticirrhus undulatus	-	-	-	-	-	0.401	-	-	-	-	-	-	0.401	0.5	97.8
Ophidion scrippsae	-	-	-	0.136	0.054	0.150	-	-	-	-	-	-	0.340	0.4	98.3
Synodus lucioceps	-	-	-	-	-	-	-	-	-	0.280	-	0.011	0.291	0.4	98.6
Citharichthys stigmaeus	-	-	-	0.013	-	0.236	-	-	-	0.003	-	-	0.252	0.3	99.0
Pleuronichthys ritteri	-	-	-	-	0.023	0.180	-	0.049	-	-	-	-	0.252	0.3	99.3
Genyonemus lineatus	-	-	-	0.078	-	0.133	-	-	-	-	-	-	0.211	0.3	99.6
Cymatogaster aggregata	-	-	-	-	-	-	-	-	-	-	-	0.086	0.086	0.1	99.7
Amphistichus argenteus	-	-	-	-	-	0.082	-	-	-	-	-	-	0.082	0.1	99.8
Scorpaena guttata	-	-	-	-	-	-	0.064	-	-	-	-	-	0.064	0.1	99.9
Leuresthes tenuis	-	-	-	-	-	-	0.053	-	-	-	-	-	0.053	0.1	99.9
Symphurus atricauda	-	-	-	-	-	0.029	-	-	-	-	-	-	0.029	0.0	100.0
Phanerodon furcatus	-	-	-	-	-	-	-	-	-	-	-	0.008	0.008	0.0	100.0
Syngathus sp	0.002	0.002	-	-	-	-	-	-	-	-	-	-	0.004	0.0	100.0
Biomass (kg)	0.452	5.145	6.152	7.390	4.038	24.573	3.441	2.437	8.218	8.244	0.003	6.711	76.804		

Note: 0.0 = < 0.05

Appendix H-8. Abundance and biomass (kg) of macroinvertebrates impinged during heat treatments and normal operations. Reliant Energy Ormond Beach generating station NPDES, 2001.

	Heat Treatment		Monitored Normal Operations		Extrapolated Normal Operations*		Total	Total
Species	Abundance	Biomass	Abundance	Biomass	Abundance	Biomass	Abundance	Biomass
Cancer antennarius	3634	38.533	53	1.562	2053	60.511	5687	99.044
Crangon nigromaculata	-	-	79	0.331	3060	12.823	3060	12.823
Cancer gracilis	1201	11.694	-	-	-	-	1201	11.694
Thetys vagina	-	-	10	1.348	387	52.220	387	52.220
Loligo opalescens	-	-	6	0.210	232	8.135	232	8.135
Loxorhynchus crispatus	14	2.044	5	0.683	194	26.459	208	28.503
Portunus xantusii	-	-	5	0.074	194	2.867	194	2.867
Panulirus interruptus	5	1.501	2	0.380	77	14.721	82	16.222
Megathura crenulata	2	0.294	1	0.121	39	4.687	41	4.981
Farfantepenaeus californiensis	-	-	1	0.041	39	1.588	39	1.588
Parastichopus sp	-	-	1	0.395	39	15.302	39	15.302
Octopus bimaculoides	27	2.331	-	-	-	-	27	2.331
Pisaster sp	15	4.167	-	-	-	-	15	4.167
Pachygrapsus crassipes	5	0.092	-	-	-	-	5	0.092
Lysmata californica	4	0.050	-	-	-	-	4	0.050
Caudina arenicola	1	0.170	-	-	-	-	1	0.170
Loxorhynchus grandis	1	0.209	-	-	-	-	1	0.209
Polyorchis penicillata	1	0.080	-	-	-	-	1	0.080
Strongylocentrotus purpuratus	1	0.920	-	-	-	-	1	0.920
Survey totals	4911	62.085	163	5.145	6314	199.313	11225	261.398
Number of species	13		10		10		19	

* Extrapolations based on flow during month sampled divided by flow on date sampled, multiplied by abundance/biomass on sampling date: 12 days sampled during year, totaling 3.23% of the annual circulation through plant.

Appendix H-9. Abundance of macroinvertebrates impinged during heat treatments. Reliant Energy Ormond Beach generating station NPDES, 2001.

	2000			2001							Percent	Cum.
Species	28-Oct	4-Nov	30-Dec	22-Feb	2-May	27-May	21-Jun	18-Aug	22-Sep	Total	Total	Percent
Cancer antennarius	18	7	-	-	-	-	8	3600	1	3634	74.0	74.0
Cancer gracilis	-	1	-	-	-	-	-	1200		1201	24.5	98.5
Octopus bimaculoides	2	-	1	-	-	-	-	24	-	27	0.5	99.0
Pisaster sp	-	-	-	5	2	-	8	-	-	15	0.3	99.3
Loxorhynchus crispatus	2	-	-	-	1	-	9	2	-	14	0.3	99.6
Pachygrapsus crassipes	3	-	-	2	-	-	-	-	-	5	0.1	99.7
Panulirus interruptus	-	-	-	1	4	-	-	-	-	5	0.1	99.8
Lysmata californica	3	-	-	-	-	-	-	-	1	4	0.1	99.9
Megathura crenulata	-	-	-	-	-	-	2		-	2	0.0	99.9
Caudina arenicola	-	1	-	-	-	-	-	-	-	1	0.0	99.9
Loxorhynchus grandis	-	-	-	-	1	-	-	-	-	1	0.0	100.0
Polyorchis penicillata	-	-	1	-	-	-	-	-	-	1	0.0	100.0
Strongylocentrotus purpuratus	-	-	-	-	-	-		1		1	0.0	100.0
Number of individuals	28	9	2	8	8	-	27	4827	2	4911		
Number of species	5	3	2	3	4	-	4	5	2	13		

Note: 0.0 = < 0.05

Appendix H-10. Biomass (kg) of macroinvertebrates impinged during heat treatments. Reliant Energy Ormond Beach generating station NPDES, 2001.

	2000			2001							Percent	Cum.
Species	28-Oct	4-Nov	30-Dec	22-Feb	2-May	27-May	21-Jun	18-Aug	22-Sep	Total	Total	Percent
Cancer antennarius	0.824	0.247	-	-	-	-	0.139	37.300	0.023	38.533	62.1	62.1
Cancer gracilis	-	0.014	-	-	-	-	-	11.680	-	11.694	18.8	80.9
Pisaster sp	-	-	-	0.084	1.198	-	2.885	-	-	4.167	6.7	87.6
Octopus bimaculoides	0.037	-	1.407	-	-	-	-	0.887	-	2.331	3.8	91.4
Loxorhynchus crispatus	0.162	-	-	-	0.098	-	1.358	0.426	-	2.044	3.3	94.7
Panulirus interruptus	-	-	-	0.308	1.193	-	-	-	-	1.501	2.4	97.1
Strongylocentrotus purpuratus	-	-	-	-	-	-	-	0.920	-	0.920	1.5	98.6
Megathura crenulata	-	-	-	-	-	-	0.294	-	-	0.294	0.5	99.0
Loxorhynchus grandis	-	-	-	-	0.209	-	-	-	-	0.209	0.3	99.4
Caudina arenicola	-	0.170	-	-	-	-	-	-	-	0.170	0.3	99.6
Pachygrapsus crassipes	0.043	-	-	0.049	-	-	-	-	-	0.092	0.1	99.8
Polyorchis penicillata	-	-	0.080	-	-	-	-	-	-	0.080	0.1	99.9
Lysmata californica	0.006	-	-	-	-	-	-	-	0.044	0.050	0.1	100.0
Biomass (kg)	1.072	0.431	1.487	0.441	2.698	-	4.676	51.213	0.067	62.085		

Appendix H-11. Abundance of macroinvertebrates impinged during normal operation by month. Reliant Energy Ormond Beach generating station NPDES, 2001.

	2000			2001										Percent	Cum.
Species	24-Oct	8-Nov	28-Dec	18-Jan	22-Feb	7-Mar	12-Apr	15-May	13-Jun	17-Jul	15-Aug	13-Sep	Total	Total	Percent
Crangon nigromaculata	-	-	-	-	30	28	18	2	-	-	-	1	79	48.5	48.5
Cancer antennarius	30	-	4	-	-	-	-	-	-	1	18	-	53	32.5	81.0
Thetys vagina	-	-	-	-	-	-	-	10	-	-	-	-	10	6.1	87.1
Loligo opalescens	3	-	-	-	-	-	-	1	-	-	1	1	6	3.7	90.8
Loxorhynchus crispatus	-		-	-	-	-	1	2	-	2	-	-	5	3.1	93.9
Portunus xantusii	-	2	-	-	1	-	2	-	-	-	-	-	5	3.1	96.9
Panulirus interruptus	-	2	-	-	-	-	-	-	-	-	-	-	2	1.2	98.2
Farfantepenaeus californiens	-	-	-	-	-	-	1	-	-	-	-	-	1	0.6	98.8
Megathura crenulata	-	-	-	-	-	-	-	-	-	1	-	-	1	0.6	99.4
Parastichopus sp	-	-	-	-	-	-	-	1	-	-	-	-	1	0.6	100.0
Number of individuals	33	4	4	-	31	28	22	16	-	4	19	2	163		
Number of species	2	2	1	-	2	1	4	5	-	3	2	2	10		

Appendix H-12. Biomass (kg) of macroinvertebrates impinged during normal operation by month. Reliant Energy Ormond Beach Generating Station NPDES, 2001.

	2000			2001										Percent	Cum.
Species	24-Oct	8-Nov	28-Dec	18-Jan	22-Feb	7-Mar	12-Apr	15-May	13-Jun	17-Jul	15-Aug	13-Sep	Total	Total	Percent
Cancer antennarius	0.260	-	0.141	-	-	-	-	-	-	0.141	1.020	-	1.562	30.36	30.4
Thetys vagina	-	-	-	-	-	-	-	1.348	-	-	-	-	1.348	26.20	56.6
Loxorhynchus crispatus	-	-	-	-	-	-	0.151	0.266	-	0.266	-	-	0.683	13.28	69.8
Parastichopus sp	-	-	-	-	-	-	-	0.395	-	-	-	-	0.395	7.68	77.5
Panulirus interruptus	-	0.380	-	-	-	-	-	-	-	-	-	-	0.380	7.39	84.9
Crangon nigromaculata	-	-	-	-	0.103	0.110	0.087	0.030	-	-	-	0.001	0.331	6.43	91.3
Loligo opalescens	0.074	-	-	-	-	-	-	0.042	-	-	0.054	0.040	0.210	4.08	95.4
Megathura crenulata	-	-	-	-	-	-	-	-	-	0.121	-	-	0.121	2.35	97.8
Portunus xantusii	-	0.055	-	-	0.002	-	0.017	-	-	-	-	-	0.074	1.44	99.2
Farfantepenaeus californiens	-	-	-	-	-	-	0.041	-	-	-	-	-	0.041	0.80	100.0
Biomass (kg)	0.334	0.435	0.141	-	0.105	0.110	0.296	2.081	-	0.528	1.074	0.041	5.145		

Appendix H-13. Total abundance of fish impinged during heat treatments and normal operations, 1990 - 2001. Reliant Energy Ormond Beach generating station NPDES, 2001.

Species	Year												Total	Percent Total	Mean
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001			
Seriphus politus	7460	43501	16697	82521	16382	24008	4218	4725	6632	161	361	3263	209929	62.81	17494.1
Sardinops sagax	322	86	110	1643	362	1056	197	2921	21434	24	89	295	28539	8.54	2378.2
Cymatogaster aggregata	278	270	997	1333	1023	8830	503	2423	891	8	366	542	17463	5.22	1455.3
Engraulis mordax	301	365	891	631	2022	1600	2169	4329	73	177	564	1144	14267	4.27	1188.9
Hyperprosopon argenteum	1506	1521	3942	550	126	616	10	1353	431	-	2	611	10667	3.19	888.9
Phanerodon furcatus	1606	987	1054	1019	1169	2454	395	926	158	-	35	36	9840	2.94	820.0
Porichthys notatus	1844	1484	999	490	336	432	11	-	-	46	58	1	5700	1.71	475.0
Genyonemus lineatus	14	707	149	2506	58	679	50	4	433	-	-	101	4701	1.41	391.8
Peprilus simillimus	1	157	72	738	22	16	4	1	1	-	5	3350	4367	1.31	363.9
Atherinops affinis	9	105	30	49	-	44	310	1620	204	-	-	974	3345	1.00	278.8
Citharichthys stigmaeus	-	390	230	504	60	240	-	-	-	-	461	1330	3215	0.96	267.9
Scomber japonicus	10	11	1848	400	451	262	5	1	54	-	-	4	3046	0.91	253.9
Paralabrax nebulifer	159	154	435	142	102	164	47	63	9	13	159	244	1691	0.51	140.9
Platyrhinoidis triseriata	46	322	33	200	76	60	2	50	72	-	29	565	1455	0.44	121.2
Pleuronichthys verticalis	64	118	126	268	104	99	-	99	70	-	202	219	1368	0.41	114.0
Trachurus symmetricus	194	15	8	266	275	499	-	2	11	-	-	-	1269	0.38	105.8
Leuresthes tenuis	1	593	364	83	11	-	-	-	-	-	-	127	1179	0.35	98.3
Myliobatis californica	-	53	78	154	85	2	1	8	15	2	-	740	1138	0.34	94.9
Leptocottus armatus	73	16	27	85	23	1	7	30	98	92	175	463	1090	0.33	90.8
Paralabrax clathratus	89	63	92	72	57	221	65	52	14	9	20	8	762	0.23	63.5
Torpedo californica	38	97	18	62	60	63	105	51	1	48	29	178	750	0.22	62.5
Porichthys myriaster	1	69	-	-	1	-	72	199	25	-	115	212	693	0.21	57.8
Ophidion scrippsae	101	106	57	76	48	58	1	-	-	-	29	207	683	0.20	56.9
Sebastes auriculatus	56	69	126	82	66	66	14	30	20	18	41	33	622	0.19	51.8
Rhacochilus toxotes	14	33	4	43	31	15	50	173	30	4	15	17	429	0.13	35.8
Symphurus atricauda	10	7	16	15	28	42	200	49	-	23	-	36	427	0.13	35.6
Amphistichus argenteus	-	4	-	2	-	-	-	-	190	-	29	118	343	0.10	28.6
Paralichthys californicus	65	17	29	92	14	16	3	1	39	-	-	62	337	0.10	28.1
Scorpaenichthys marmoratus	67	39	26	19	15	43	14	32	6	1	16	24	303	0.09	25.2
Xenistius californiensis	2	26	-	38	12	111	57	11	37	-	1	1	296	0.09	24.7
Embiotoca jacksoni	81	56	28	20	30	30	7	10	7	2	8	11	291	0.09	24.2
Rhacochilus vacca	67	94	32	27	25	19	1	-	2	4	1	2	273	0.08	22.8
Chromis punctipinnis	16	22	100	32	16	9	13	8	29	2	2	3	252	0.08	21.0
Pleuronectes vetulus	9	-	-	-	8	-	-	49	155	-	-	-	221	0.07	18.4
Pleuronichthys ritteri	-	1	2	-	-	1	-	-	-	-	-	213	217	0.06	18.1
Acanthogobius flavimanus	-	-	-	-	-	-	-	-	190	23	-	-	213	0.06	17.8
Atherinopsis californiensis	1	28	37	118	7	15	-	-	-	-	1	-	207	0.06	17.3
Brachyistius frenatus	18	3	6	36	20	50	17	-	28	-	-	1	180	0.05	15.0
Sygnathus sp	-	-	-	-	-	-	-	-	-	-	175	-	175	0.05	14.6
Syngnathus sp.	-	15	-	58	1	-	-	-	-	23	-	73	170	0.05	14.2
Synodus lucioceps	9	7	-	-	7	-	-	-	-	-	-	143	166	0.05	13.9
Oxyjulis californica	2	4	16	21	8	11	17	3	7	3	43	14	149	0.04	12.4
Paralabrax maculatofasciatus	-	-	8	-	-	-	47	-	87	-	3	-	145	0.04	12.1
Heterostichus rostratus	21	14	13	12	44	33	3	2	-	-	1	-	144	0.04	12.0
Sebastes paucispinis	29	46	22	8	-	-	-	-	-	-	29	-	135	0.04	11.2
Scorpaena guttata	7	4	2	21	33	17	3	-	5	1	1	33	127	0.04	10.6
Rhinobatos productus	27	2	-	17	8	1	4	32	30	-	1	-	122	0.04	10.1
Pleuronichthys coenosus	1	6	1	19	57	15	1	-	-	-	-	-	100	0.03	8.3
Menticirrhus undulatus	-	10	-	-	1	-	-	-	2	-	-	71	84	0.03	7.0
Cheilotrema saturnum	1	4	1	4	17	42	-	-	4	1	1	4	79	0.02	6.6
Triakis semifasciata	-	-	1	-	-	-	-	-	4	-	-	66	71	0.02	5.9
Mustelus californicus	-	15	-	7	-	14	34	-	-	-	-	-	70	0.02	5.9
Urolophus halleri	-	2	2	3	1	1	-	1	1	23	-	36	70	0.02	5.8
Medialuna californiensis	3	6	6	2	31	10	-	-	-	-	-	-	58	0.02	4.8
Squalus acanthias	-	7	8	29	-	-	1	-	12	-	-	-	58	0.02	4.8
Hypsopsetta guttulata	-	8	-	-	14	-	-	-	-	23	-	-	45	0.01	3.8
Hypsurus caryi	-	9	12	4	4	11	1	1	-	-	-	-	42	0.01	3.5
Atractoscion nobilis	-	6	-	15	3	3	3	2	7	-	1	-	40	0.01	3.3
Oxylebius pictus	4	-	21	-	4	2	-	-	-	-	1	1	33	0.01	2.8
Chilara taylori	9	22	-	1	-	-	-	-	-	-	-	-	32	0.01	2.7

Appendix H-13. (Cont.).

Species	Year 1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total	Percent Total	Mean
Sebastes rastrelliger	4	6	3	10	1	6	-	-	2	-	-	-	32	0.01	2.7
Cephaloscyllium ventriosum	-	7	1	23	-	-	-	-	-	-	-	-	31	0.01	2.6
Sebastes serranoides	12	-	9	1	5	-	-	-	-	-	4	-	31	0.01	2.6
Citharichthys xanthostigma	-	22	-	7	-	-	-	-	-	-	-	-	29	0.01	2.4
Mustelus sp	-	-	-	-	-	-	-	-	-	23	-	1	24	0.01	2.0
Merluccius productus	-	22	-	-	-	-	-	-	-	-	-	-	22	0.01	1.8
Girella nigricans	11	7	-	-	-	-	-	-	-	-	1	-	19	0.01	1.6
Anisotremus davidsonii	1	-	-	2	4	-	-	-	12	-	-	-	19	0.01	1.6
Xystreurys liolepis	10	-	1	-	7	-	-	-	-	-	-	-	18	0.01	1.5
Sebastes atrovirens	-	1	-	1	-	8	1	-	-	-	-	-	11	0.00	0.9
Sphyraena argentea	-	-	-	8	-	1	-	-	1	-	-	-	10	0.00	0.9
Hypsoblennius gilberti	-	1	1	4	4	-	-	-	-	-	-	-	10	0.00	0.8
Anchoa compressa	-	-	-	7	1	-	-	-	-	-	-	-	8	0.00	0.7
Hermosilla azurea	-	7	-	-	-	-	-	1	-	-	-	-	8	0.00	0.7
Platichthys stellatus	-	7	-	-	-	-	1	-	-	-	-	-	8	0.00	0.7
Hypsoblennius spp.	1	-	-	-	7	-	-	-	-	-	-	-	8	0.00	0.7
Sebastes caurinus	-	-	-	-	-	-	-	-	7	-	-	-	7	0.00	0.6
Eopsetta jordani	-	-	-	-	7	-	-	-	-	-	-	-	7	0.00	0.6
Icichthys lockingtoni	-	-	-	-	7	-	-	-	-	-	-	-	7	0.00	0.6
Halichoeres semicinctus	2	-	2	-	-	-	-	-	-	-	-	2	6	0.00	0.5
Hexagrammos decagrammus	-	3	2	-	-	-	-	-	-	-	-	-	5	0.00	0.4
Psettichthys melanostictus	-	-	-	-	-	-	-	-	4	-	-	-	4	0.00	0.3
Embiotoca lateralis												3	3	0.00	3.0
Hypsoblennius gentilis	-	-	-	1	-	-	-	-	-	2	-	-	3	0.00	0.3
Sebastes flavidus	-	-	-	-	-	-	-	-	-	3	-	-	3	0.00	0.3
Semicossyphus pulcher	-	-	-	-	2	-	-	1	-	-	-	-	3	0.00	0.3
Amphistichus koelzi	-	-	-	-	-	-	-	-	-	2	-	-	2	0.00	0.2
Ophiodon elongatus	1	-	-	-	-	-	-	-	-	-	-	1	2	0.00	0.2
Sebastes serriceps	1	-	-	-	-	-	-	1	-	-	-	-	2	0.00	0.2
Zalembius rosaceus	-	-	-	-	-	-	-	2	-	-	-	-	2	0.00	0.2
Agonopsis sterletus	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	0.1
Artedius corallinus	1	-	-	-	-	-	-	-	-	-	-	-	1	0.00	0.1
Balistes polylepis	-	1	-	-	-	-	-	-	-	-	-	-	1	0.00	0.1
Clinocottus sp	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	0.1
Heterodontus francisci	-	-	-	-	-	-	-	-	1	-	-	-	1	0.00	0.1
Raja binoculata	-	-	1	-	-	-	-	-	-	-	-	-	1	0.00	0.1
Raja inornata	-	-	-	1	-	-	-	-	-	-	-	-	1	0.00	0.1
Sebastes goodei	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	0.1
Sebastes melanops	-	-	-	-	-	-	-	-	-	-	1	-	1	0.00	0.1
Number of individuals	14681	51862	28800	94604	23399	41997	8665	19266	31545	763	3078	15583	334243		31558.2
Number of species	54	65	54	60	59	48	41	38	47	28	42	47	99		49.4

Note: 0.00 = <0.005

Total abundance based on heat treatment and extrapolated normal operations.

1990 extrapolations based on 40 sample days and 365 days of circulator operation.

1991 extrapolations based on 50 sample days and 365 days of circulator operation.

1992 extrapolations based on 42 sample days and 342 days of circulator operation.

1993 extrapolations based on 50 sample days and 365 days of circulator operation.

1994 extrapolations based on 50 sample days and 345 days of circulator operation.

1995 extrapolations based on 21 sample days and 7.07% of the total annual flow through the generating station.

1996 extrapolations based on six sample days and 3.00% of the total annual flow through the generating station.

1997 extrapolations based on nine sample days and 4.06% of the total annual flow through the generating station.

1998 extrapolations based on eight sample days and 8.60% of the total annual flow through the generating station (except for *Pleuronectes vetulus*, *Psettichthys melanostictus*, and *Triakis semifasciata*).

1999 extrapolations based on flow data, using a multiplier (23.09) based on eight sample days and monthly flow information.

2000 extrapolations based on flow data, using a multiplier (28.76) based on nine sample days and monthly flow information (except for *Agonopsis sterletus*).

2001 extrapolations based on flow data. Multiplier based on monthly flow divided by flow on date sampled that month. Average multiplier = 31.86, based on 12 sample dates and 3.23% of the total annual flow through the generating station.